PRICE $2.00

HEATH COMPANY • BENTON HARBOR, MICHIGAN

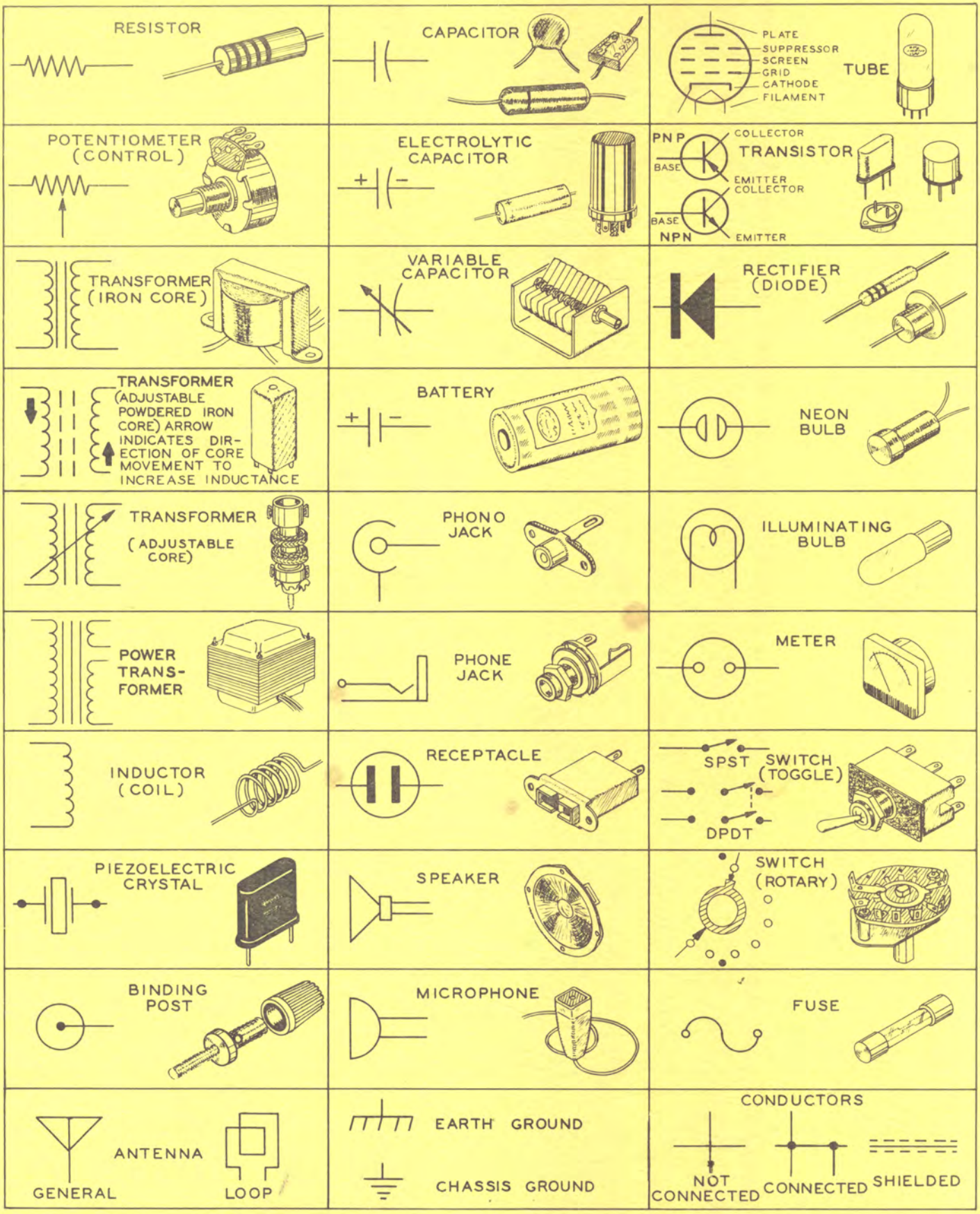
HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT®

LOW COST TRANSISTOR RECEIVER
MODEL AR-14

TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations should prove helpful in identifying most parts and reading the schematic diagrams.



Assembly
and
Operation
of the

HEATHKIT

LOW COST TRANSISTOR RECEIVER

MODEL AR-14

NOTE: RECEIVER IS SHOWN INSTALLED IN THE AE-55 WALNUT CABINET ACCESSORY.

HEATH COMPANY
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INTRODUCTION

The Heathkit Model AR-14 FM Stereo Receiver contains an all solid-state circuit that provides high quality reception of standard FM and FM stereo signals. Each of its amplifier channels also has input connectors for mono and stereo phonograph and auxiliary signals. Tape Output connectors are also provided. The mode of operation (FM, Phono, etc.) is selected by the Source switch on the front panel.

All controls (Source, Treble, Bass, Volume, Phase, and Tuning) are located on the front panel. The Phono and Auxiliary input connectors are located on the rear panel, along with the Tape Output connectors.

The FM Tuner circuit contains a preassembled and prealigned FM tuning unit. All critical parts in the other FM circuits have been aligned at the factory, so only a few simple adjustments are needed after the kit is assembled. These simple adjustments can be completed without using instruments.

The solid-state amplifier circuits provide you with high-fidelity sound reproduction at low cost. Both amplifier channels have a frequency response of ±1 db from 12 to 60,000 cps at full power output. The transformerless audio output circuit insures minimum phase shift, widest response, and lowest distortion. Tandem construction was used on the Bass and Treble controls so each channel can be adjusted simultaneously. A concentric clutched Volume control is used for independent level adjustment of each channel. A speaker defeat switch allows the speakers to be turned off when stereo headphones are plugged into the convenient front panel jack.

The use of the latest type of output circuit eliminates the problem of severe transistor damage that occurs in other equipment when the output terminals are accidentally shorted. The output stage in this amplifier will withstand an accidental shorted output for periods of up to 30 seconds with no damage to the transistors or other components.

This receiver also features flywheel tuning, and a stereo indicator lamp to indicate when an FM stereo signal is being received. The all-transistor construction provides long life, low heat, freedom from hum and virtually service-free operation. Excellent performance can be expected when this receiver is used with an antenna (either indoor or outdoor) that provides proper signal pickup in your area. The receiver can be panel mounted or installed in one of the following Heathkit Accessory Cabinets: Model AE-55 Walnut Cabinet; or the Model AE-65 Metal Cabinet.

NOTE: Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

The numbers in parentheses are keyed to the numbers on the Parts Pictorial (fold-out from Page 5).

PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS		
1/4 Watt		
(1) 1L-20	3	33 Ω (orange-orange-black)
1L-1	4	100 Ω (brown-black-brown)
1L-37	1	150 Ω (brown-green-brown)
1L-17	1	220 Ω (red-red-brown)
1L-21	2	270 Ω (red-violet-brown)
1L-23	2	390 Ω (orange-white-brown)
1L-35	1	470 Ω (yellow-violet-brown)
1L-13	6	560 Ω (green-blue-brown)
1L-24	3	820 Ω (gray-red-brown)
1L-2	9	1000 Ω (brown-black-red)
1L-3	1	1200 Ω (brown-red-red)
1L-36	5	1500 Ω (brown-green-red)
1L-4	6	2200 Ω (red-red-red)
1L-6	2	3300 Ω (orange-orange-red)
1L-8	4	4700 Ω (yellow-violet-red)
1L-26	11	5600 Ω (green-blue-red)
1L-27	8	6800 Ω (blue-gray-red)
1L-9	5 4	10 KΩ (brown-black-orange)
1L-10	3	15 KΩ (brown-green-orange)
1L-41	2	33 KΩ (orange-orange-orange)
1L-29	5	39 KΩ (orange-white-orange)
1L-11	7	47 KΩ (yellow-violet-orange)
1L-30	4	56 KΩ (green-blue-orange)
1L-31	1	68 KΩ (blue-gray-orange)
1L-32	6	100 KΩ (brown-black-yellow)
1L-33	1	120 KΩ (brown-red-yellow)
1L-16	4	180 KΩ (brown-gray-yellow)
1L-38	2	220 KΩ (red-red-yellow)
1L-39	2	390 KΩ (orange-white-yellow)
1L-19	1	1 megohm (brown-black-green)
Other Resistors		
(2) 4-9	2	91 Ω (white-brown-black) 1/2 watt, low noise
(3) 1-3	2	100 Ω (brown-black-brown) 1/2 watt
1-9	2	1000 Ω (brown-black-red) 1/2 watt
Other Resistors (cont'd.)		
(4) 1A-18	5	150 Ω (brown-green-brown) 1 watt
1A-19	1	220 Ω (red-red-brown) 1 watt
1A-54	1	270 Ω (red-violet-brown) 1 watt
(5) 3B-7	4	1 Ω (brown-black-gold) 2 watt, same physical size as 1 watt
(6) 3E-15	1	75 Ω 5 watt
3E-19	1	330 Ω 5 watt
CAPACITORS		
Disc		
(7) 21-61	1	6.8 μμf
21-3	2	10 μμf
21-17	3	270 μμf
21-14	2	.001 μfd
21-36	4	.002 μfd
21-27	2	.005 μfd
(8) 21-47	12	.01 μfd, 50 V
(9) 21-42	1	.01 μfd, 1600 V
Silver Mica		
(10) 20-103	1	150 μμf
20-108	1	200 μμf
20-106	1	390 μμf
20-113	1	470 μμf
20-107	1	680 μμf
Resin		
(11) 27-41	4	.0022 μfd
27-42	2	.0068 μfd
27-44	2	.01 μfd
27-43	2	.047 μfd
(12) 27-34	1	.2 μfd

PART No.	PARTS Per Kit	DESCRIPTION
Electrolytic		
(13) 25-123	2	2 μfd, 25 V
25-125	1	5 μfd, 10 V
25-136	2	10 μfd, 15 V or 20 V
25-54	10	10 μfd, 10 V
25-153	2	100 μfd, 3 V
(14) 25-115	2	10 μfd, 12 V
(15) 25-146	4	100 μfd, 30 V
(16) 25-157	6	500 μfd, 15 V
(17) 25-154	2	2500 μfd, 30 V
(18) 25-156	1	4000 μfd, 50 V
Other Capacitors		
(19) 29-3	1	2700 μμf, 125 V
29-2	1	.01μfd (10,000 μμf) tubular, 5%
COILS-CHOKE-TRANSFORMERS		
(20) 40-543	1	19 kc tank circuit coil
40-545	1	38 kc oscillator coil
40-556	1	38 kc series trap coil
40-697	1	67 kc parallel trap
(21) 45-7	1	90 μh choke
(22) 52-81	3	10.7 mc IF transformer
53-9	1	10.7 mc ratio detector transformer
54-163	1	Power transformer
TRANSISTORS-DIODES-PEC		

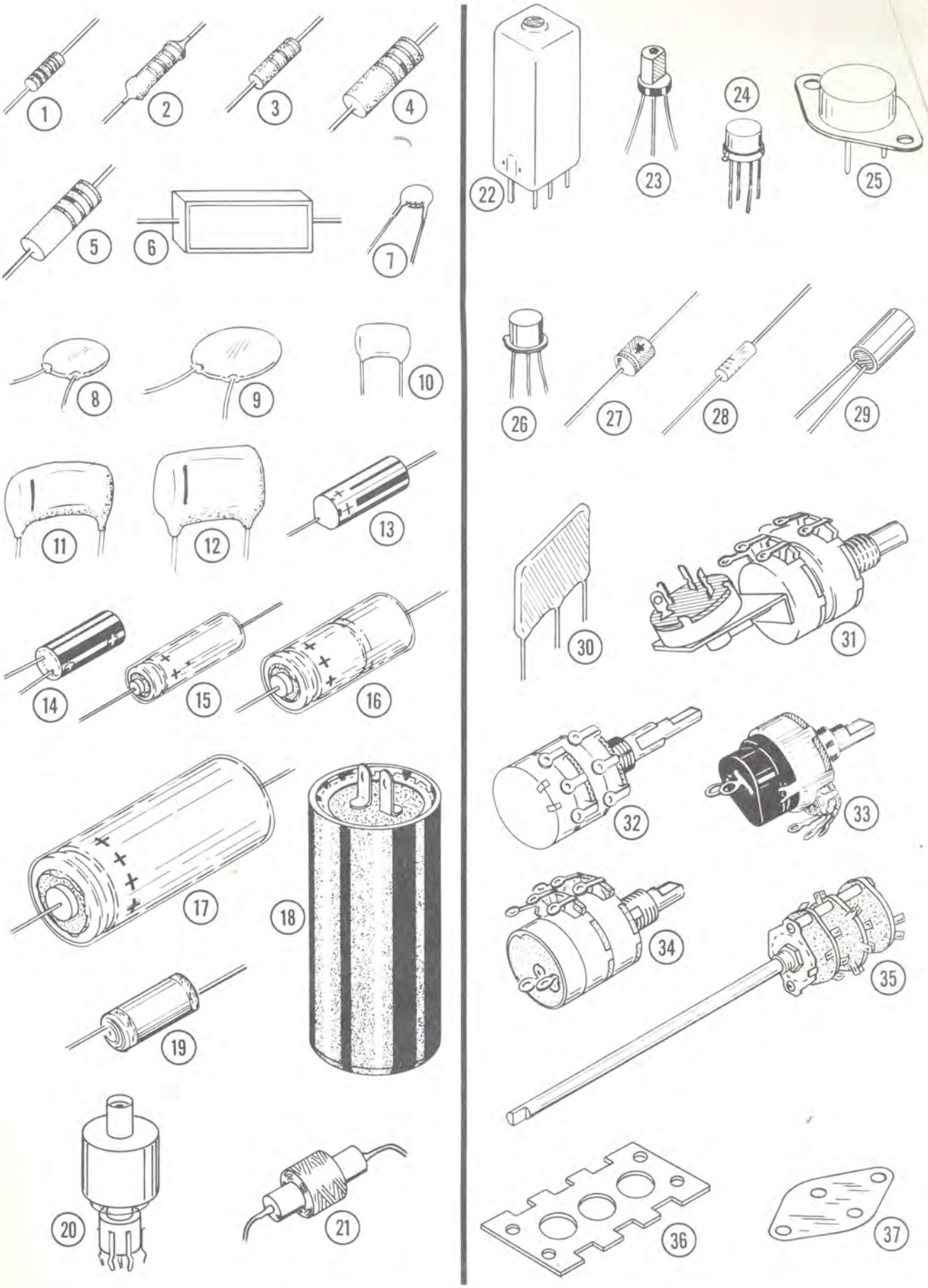
NOTE: The diodes and transistors supplied will be the transistor types listed below or an equivalent. They will either have the Part Number or the listed Type number stamped on them.

(23) 417-67	13	Transistor, 2N2712
417-77	1	Transistor, 2N2712 (blue color dot)
417-91	2	Transistor, 2N3391
417-94	2	Transistor, 2N3416
(24) 417-71	4	Transistor, 2N2654
(25) 417-99	2	Transistor, 2N2148
417-101	2	Transistor, TA2577A
(26) 417-100	2	Transistor, 2N3053
(27) 57-29	4	Diode, silicon
(28) 56-26	1	Diode (brown-white-brown)
(29) 56-33	2	Diode, 1N3754
(30) 84-36	2	PEC (packaged electronic circuit)

PART No.	PARTS Per Kit	DESCRIPTION
CONTROLS-SWITCHES		
(31) 19-101	1	50 KΩ, dual control with push-pull switch
(32) 12-66	1	10 KΩ dual control
(33) 19-97	1	10 KΩ control with push-pull switch
(34) 19-96	1	50 KΩ, dual control with push-pull switch
(35) 63-411	1	Selector switch
SOCKETS-INSULATORS-JACK-TERMINAL STRIPS-GEARS		
(36) 75-41	2	Phono socket insulator
(37) 75-60	4	Mica insulator (packed between two pieces of cardboard)
(38) 434-76	2	Triple phono socket
(39) 434-117	4	Transistor socket
(40) 434-147	2	AC socket
(41) 434-152	2	Dial lamp socket
(42) 436-27	1	Phone jack
(43) 431-6	1	2-lug screw type terminal strip
(44) 431-40	1	4-lug terminal strip
(45) 431-55	1	6-lug terminal strip
(46) 431-38	1	3-lug miniature terminal strip
(47) 431-70	2	Output terminal strip
(48) 451-15	1	Drive gear
(49) 451-16	1	Anti-backlash gear
METAL PARTS		
(50) 100-M577F	1	Front panel
(51) 100-M576F	1	Control panel
(52) 202-M60P268	1	Rear panel
(53) 202-M59	1	Left end panel
(54) 204-M694	1	Right end panel
(55) 200-M455	1	Center panel
(56) 204-M690	1	Support panel
(57) 205-M508	1	Bottom panel
(58) 200-M456	1	Power supply chassis
(59) 206-M286	1	Transformer shield
(60) 206-M284	1	Input shield
(61) 100-M588	1	Circuit board shield
(62) 100-M587	2	Heat sink
(63) 205-M509	1	Alignment plate
(64) 204-M692	1	Gear mounting bracket
(65) 204-M693	1	Dial shaft bracket
(66) 204-M691	1	Long angle bracket
(67) 206-M285F	2	Dial lamp shield
(68) 205-M347	2	Transistor retaining plate

PART No.	PARTS Per Kit	DESCRIPTION
Metal Parts (cont'd.)		
(69) 204-135	2	L bracket
(70) 100-M589	1	Capacitor clamp
(71) 100-M433	1	Pulley bracket
WIRE-CABLES-SLEEVING-TWIN LEAD-TAPE		
344-15	1	Black stranded wire
344-50	1	Black hookup wire
344-51	1	Brown hookup wire
344-52	1	Red hookup wire
344-54	1	Yellow hookup wire
344-55	1	Green hookup wire
344-56	1	Blue hookup wire
344-57	1	Violet hookup wire
344-58	1	Gray hookup wire
344-59	1	White hookup wire
347-3	1	2-wire shielded cable
347-7	1	4-wire cable
347-1	1	8-wire cable
343-7	1	Coaxial cable
347-2	1	Twin lead
89-13	1	Line cord
346-1	1	Sleeving
73-39	1	Foam tape
HARDWARE		
#2 Hardware		
(72) 250-182	2	2-56 x 1/4" screw
(73) 252-51	2	2-56 nut
#3 Hardware		
(74) 254-7	2	#3 lockwasher
#4 Hardware		
(75) 250-52	3	4-40 x 1/4" screw
(76) 250-163	19	4-40 x 5/16" self-tapping screw
(77) 254-9	14	#4 lockwasher
#6 Hardware		
(78) 250-56	3	6-32 x 1/4" screw
(79) 250-89	8	6-32 x 3/8" screw
(80) 250-106	2	6-32 x 3/8" self-tapping screw
(81) 250-162	17	6-32 x 1/2" screw
(82) 250-170	48	#6 x 1/4" sheet metal screw
(83) 250-8	2	#6 x 3/8" sheet metal screw
(84) 250-284	2	#6 x 1/2" sheet metal screw
(85) 250-100	2	6-32 x 5/16" setscrew
(86) 254-1	30	#6 internal lockwasher
(87) 254-6	3	#6 external lockwasher
(88) 252-3	28	6-32 nut
(89) 252-23	1	6-32 thumbnut
(90) 259-1	2	#6 solder lug
#8 Hardware		
(91) 250-137	4	8-32 x 3/8" screw
(92) 250-16	2	8-32 x 3/16" setscrew
(93) 250-43	1	8-32 x 1/4" setscrew
(94) 254-2	4	#8 lockwasher
(95) 252-4	4	8-32 nut
Other Hardware		
(96) 455-9	2	Bushing
(97) 254-5	6	Control lockwasher
(98) 252-7	12	Control nut
(99) 259-10	1	Control solder lug
(100) 253-60	2	Thin flat washer
(101) 253-62	1	Fiber flat washer
(102) 253-11	2	E washer
(103) 259-22	4	Spade lug
(104) 260-24	2	Diode clip
(105) 258-1	1	Dial cord spring
(106) 207-4	2	Cable clamp
MISCELLANEOUS		
110-30	1	FM tuner
85-125P208	1	FM-multiplex circuit board
85-137P240	1	Amplifier circuit board
100-M166	1	Dial pulley
463-31	1	Dial pointer
(107) 454-2	1	Flywheel
(108) 453-104	1	Short shaft
453-120	1	Long shaft
(109) 75-71	1	Strain relief
(110) 261-23	4	Plastic foot
423-2	1	Fuseholder
412-1	2	#47 dial lamp
(111) 412-31	1	Indicator lamp
421-23	1	Fuse, 1 ampere slow blow
462-212	4	Knob for 1/4" shaft
462-213	1	Knob for 3/16" shaft
462-225	1	Knob with setscrew
(112) 462-214	1	Lever knob
100-M425	1	Dial cord assembly
352-M8	1	Silicone grease (in can)
(113) 490-1	1	Plastic alignment tool
490-5	1	Nut starter
597-308	1	Kit Builders Guide
331-6	1	Solder
	1	Blue and white label
	1	Parts Order Form
595-778	1	Manual

PARTS PICTORIAL



PARTS PICTORIAL CONTINUED
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STEP-BY-STEP ASSEMBLY

Before starting to assemble this kit, read the Kit Builders Guide for complete information on wiring, soldering, and step-by-step assembly procedures.

FM-MULTIPLEX CIRCUIT BOARD (#85-125P208)

Before you start the circuit board assembly be sure to read the Circuit Board Parts Mounting and the Soldering sections of the Kit Builders Guide.

Position the circuit board on your work surface as shown in Pictorial 1. Resistors will be called out by only the resistance value (in Ω, KΩ, or megohm) and color code. Capacitors will be called out by only the capacitance value and type.

START

NOTE: 1/4 watt resistors will be installed on the left-hand side of the circuit board in the following steps.

( ) 10 KΩ (brown-black-orange).

( ) 220 KΩ (red-red-yellow).

( ) 15 KΩ (brown-green-orange).

( ) 2200 Ω (red-red-red).

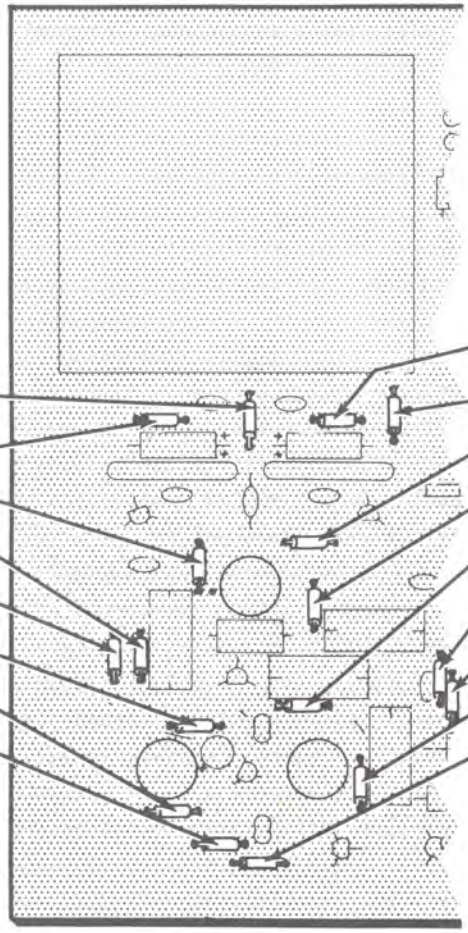
( ) 6800 Ω (blue-gray-red).

( ) 560 Ω (green-blue-brown).

( ) 47 KΩ (yellow-violet-orange).

( ) 120 KΩ (brown-red-yellow).

( ) Solder all leads to the foil side of the circuit board. Do not fill the unused holes with solder. After soldering, clip off the excess lead lengths.



CONTINUE

( ) 220 KΩ (red-red-yellow).

( ) 33 Ω (orange-orange-black).

( ) 47 KΩ (yellow-violet-orange).

( ) 39 KΩ (orange-white-orange).

( ) 560 Ω (green-blue-brown).

( ) 1 megohm (brown-black-green).

( ) 6800 Ω (blue-gray-red).

( ) 47 KΩ (yellow-violet-orange).

( ) 1000 Ω (brown-black-red).

( ) Solder all leads and clip off the excess lead lengths.

PROCEED TO PICTORIAL 2.

PICTORIAL 1

START

NOTE: 1/4 watt resistors, a diode, and a wire will be installed on the right-hand side of the circuit board in the following steps.

( ) 3300 Ω (orange-orange-red).

( ) 1500 Ω (brown-green-red).

( ) 3300 Ω (orange-orange-red).

( ) 47 KΩ (yellow-violet-orange).

( ) 5600 Ω (green-blue-red).

( ) 1500 Ω (brown-green-red).

( ) 10 KΩ (brown-black-orange).

( ) Diode (brown-white-brown). Position the banded end as shown. NOTE: Do not confuse the banded end with the copper colored wire that is visible inside the diode.

( ) 33 Ω (orange-orange-black).

( ) 5600 Ω (green-blue-red).

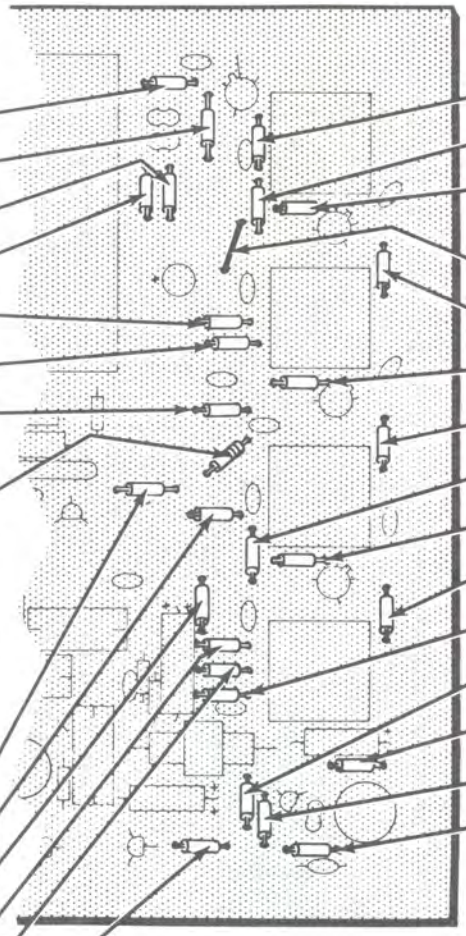
( ) 6800 Ω (blue-gray-red).

( ) 1000 Ω (brown-black-red).

( ) 150 Ω (brown-green-brown).

( ) 33 Ω (orange-orange-black).

( ) Solder all leads and clip off the excess lead lengths.



CONTINUE

( ) 5600 Ω (green-blue-red).

( ) 1500 Ω (brown-green-red).

( ) 1000 Ω (brown-black-red).

( ) 1" bare wire. Use one of the cut-off resistor leads.

( ) 270 Ω (red-violet-brown).

( ) 1000 Ω (brown-black-red).

( ) 270 Ω (red-violet-brown).

( ) 1200 Ω (brown-red-red).

( ) 1000 Ω (brown-black-red).

( ) 470 Ω (yellow-violet-brown).

( ) 1500 Ω (brown-green-red).

( ) 68 KΩ (blue-gray-orange).

( ) 10 KΩ (brown-black-orange).

( ) 2200 Ω (red-red-red).

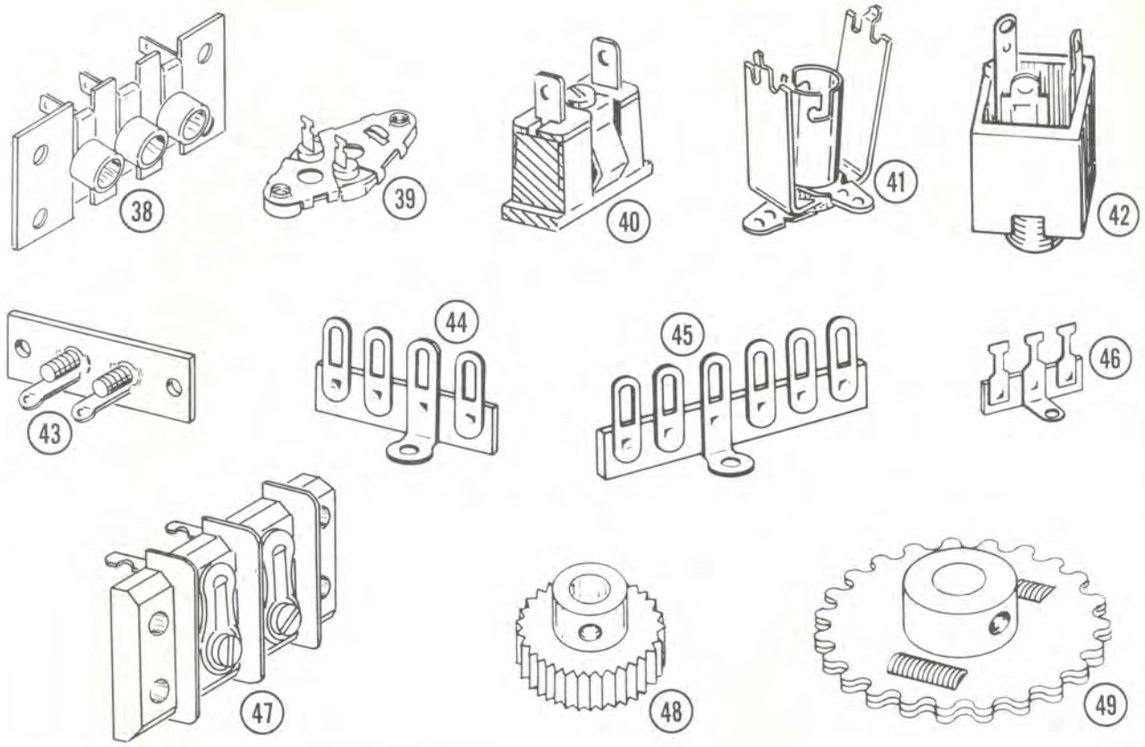
( ) 220 Ω (red-red-brown).

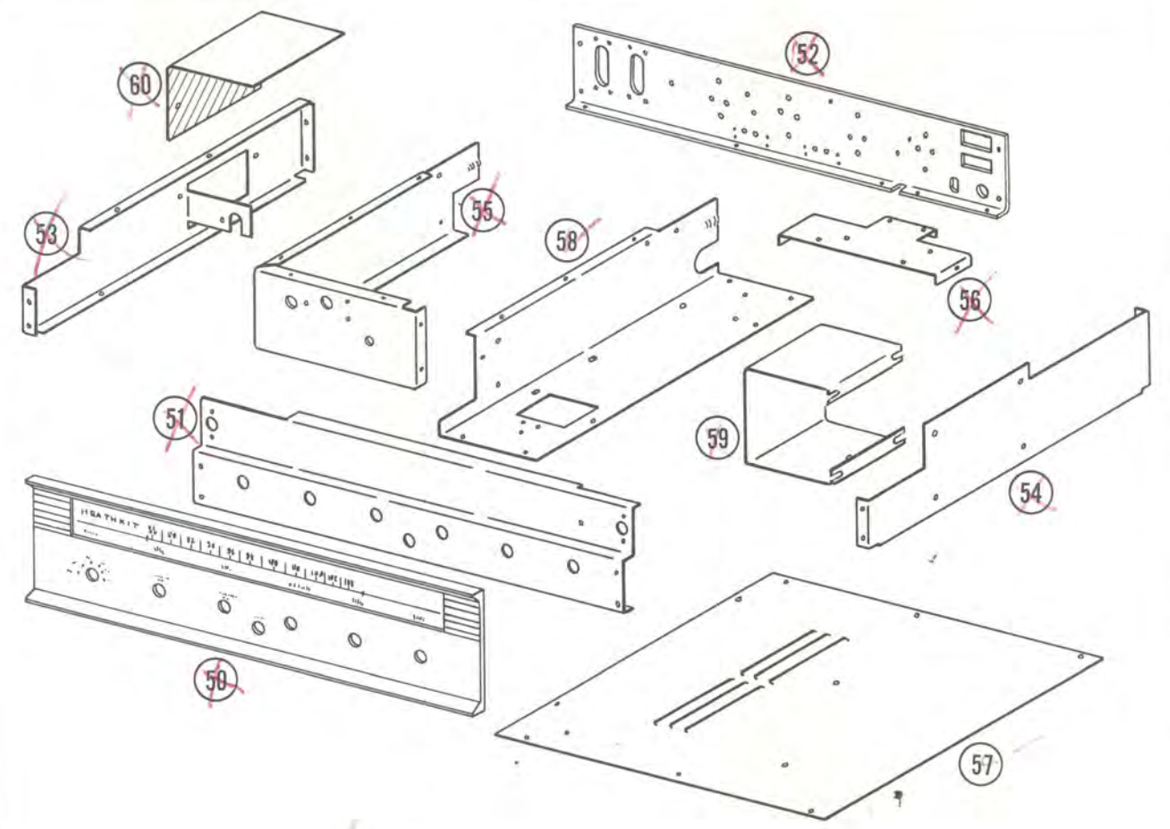
( ) Solder all leads and clip off the excess lead lengths.

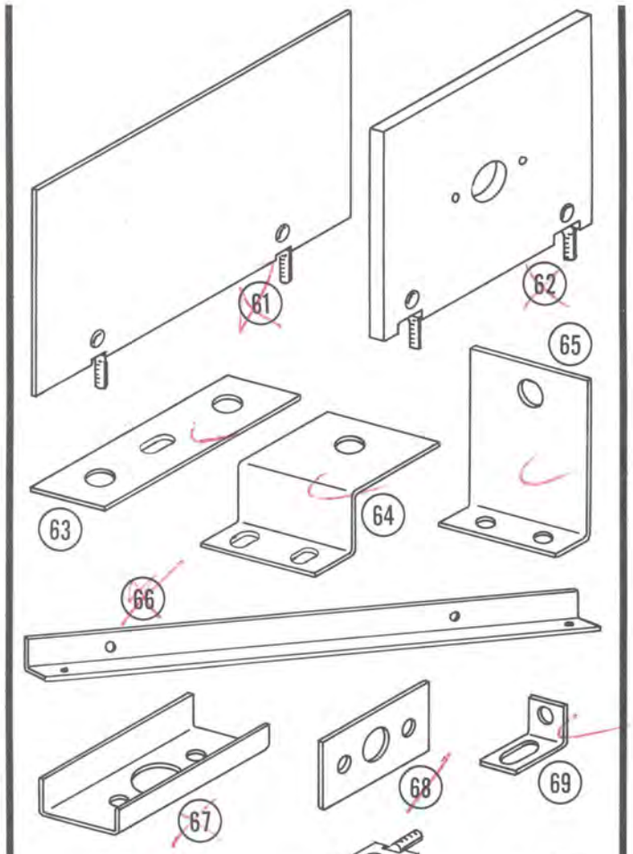
PROCEED TO PICTORIAL 3.

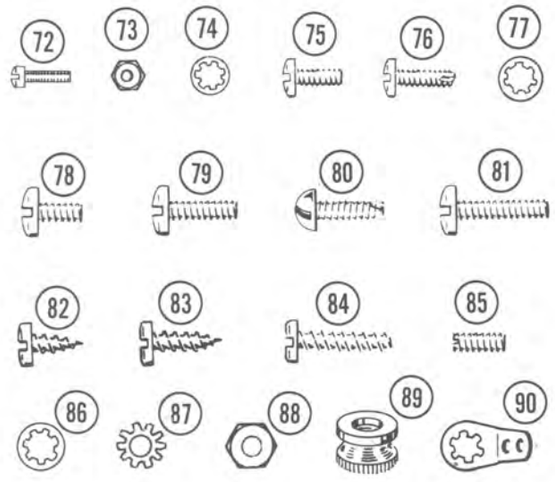
PICTORIAL 2

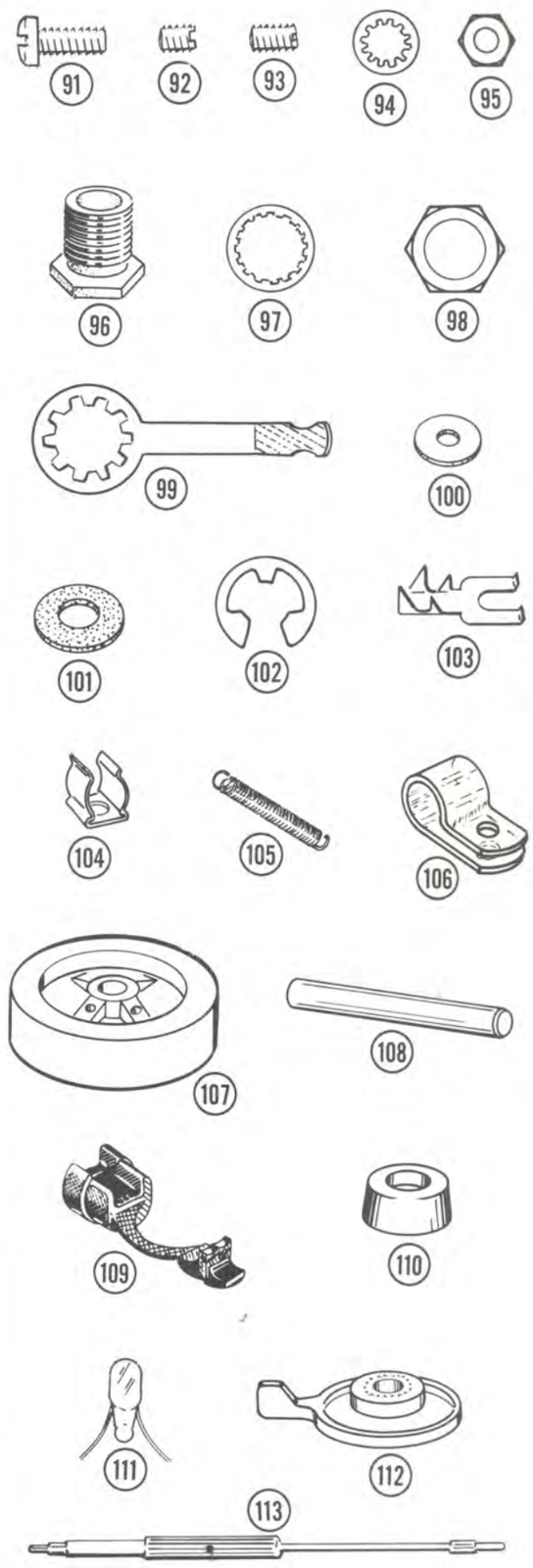
PARTS PICTORIAL (CONT'D.)











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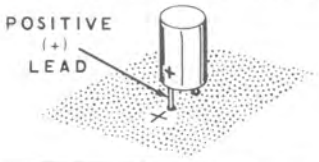
START

NOTE: Capacitors and a choke will be installed on the right-hand side of the circuit board in the following steps. Capacitors will be called out by capacitance value and the type of capacitor only.

( ) 150 μμf mica.

( ) 470 μμf mica.

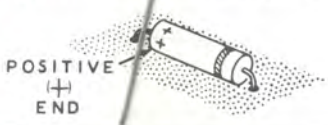
( ) 10 μfd electrolytic. Position the positive (+) lead as shown.



( ) Set aside the .01 μfd 1.6 KV disc ceramic capacitor, so it will not be installed by mistake with the .01 μfd disc capacitors.

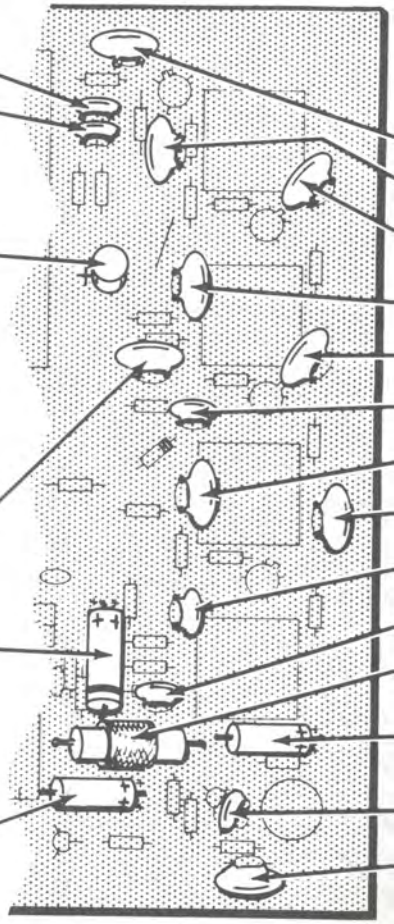
( ) .01 μfd disc ceramic.

( ) 5 μfd electrolytic. Position the positive (+) lead as shown.



( ) 10 μfd electrolytic, 10 V. Position the positive (+) lead as shown.

( ) Solder all leads and clip off the excess lead lengths.



CONTINUE

( ) .01 μfd disc ceramic.

( ) .01 μfd disc ceramic.

( ) .01 μfd disc ceramic.

( ) .01 μfd disc ceramic.

( ) .01 μfd disc ceramic.

( ) 6.8 μμf disc ceramic.

( ) .01 μfd disc ceramic.

( ) .01 μfd disc ceramic.

( ) 270 μμf disc ceramic.

( ) 270 μμf disc ceramic.

( ) 90 μh choke (#45-7).

( ) 10 μfd electrolytic, 10 V. Position the positive (+) lead as shown.

( ) 680 μμf mica.

( ) .01 μfd disc ceramic.

( ) Solder all leads and clip off the excess lead lengths.

PROCEED TO PICTORIAL 4.

PICTORIAL 3

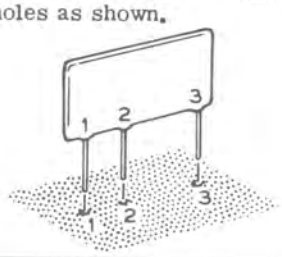
START

NOTE: Capacitors and packaged electronic circuits (PEC) will be installed on the left-hand side of the circuit board in the following steps.

( ) .002 µfd disc ceramic.

( ) 10 µfd electrolytic, 10 V. Position the positive (+) lead as shown.

( ) PEC (#84-36). Insert the numbered leads in the numbered holes as shown.



( ) .001 µfd disc ceramic.

( ) .01 µfd disc ceramic.

( ) .01 µfd disc ceramic.

NOTE: The resin capacitors are marked with a band on one end. However, this can be disregarded when installing the capacitors.

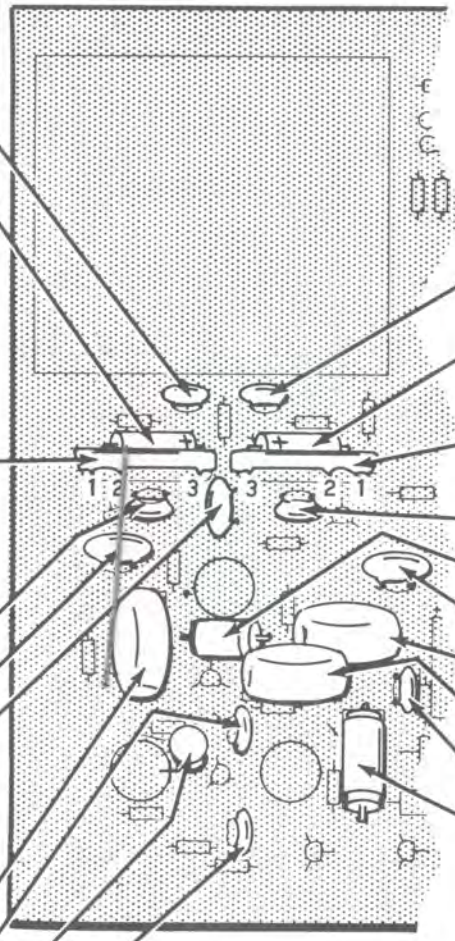
( ) .2 µfd resin.

( ) 390 µµf mica.

( ) 10 µfd electrolytic 12 V. Position the positive (+) lead as shown.

( ) 200 µµf mica.

( ) Solder all leads and clip off the excess lead lengths.



CONTINUE

( ) .002 µfd disc ceramic.

( ) 10 µfd electrolytic, 10 V. Position the positive (+) lead as shown.

( ) PEC (#84-36). Insert the numbered leads in the numbered holes as shown.

( ) .001 µfd disc ceramic.

( ) 2700 µµf tubular.

( ) .01 µfd disc ceramic.

( ) .01 µfd resin.

( ) .01 µfd resin.

( ) 270 µµf disc ceramic.

( ) .01 µfd (10,000 µµf) tubular.

( ) Solder all leads and clip off the excess lead lengths.

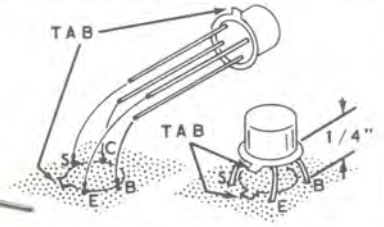
PROCEED TO PICTORIAL 5.

PICTORIAL 4

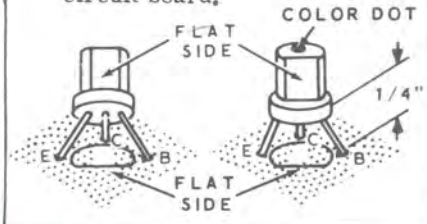
START

NOTE: Transistors will be installed on the circuit board in the following steps. Solder the leads after each transistor is installed; then cut off the excess lead lengths.

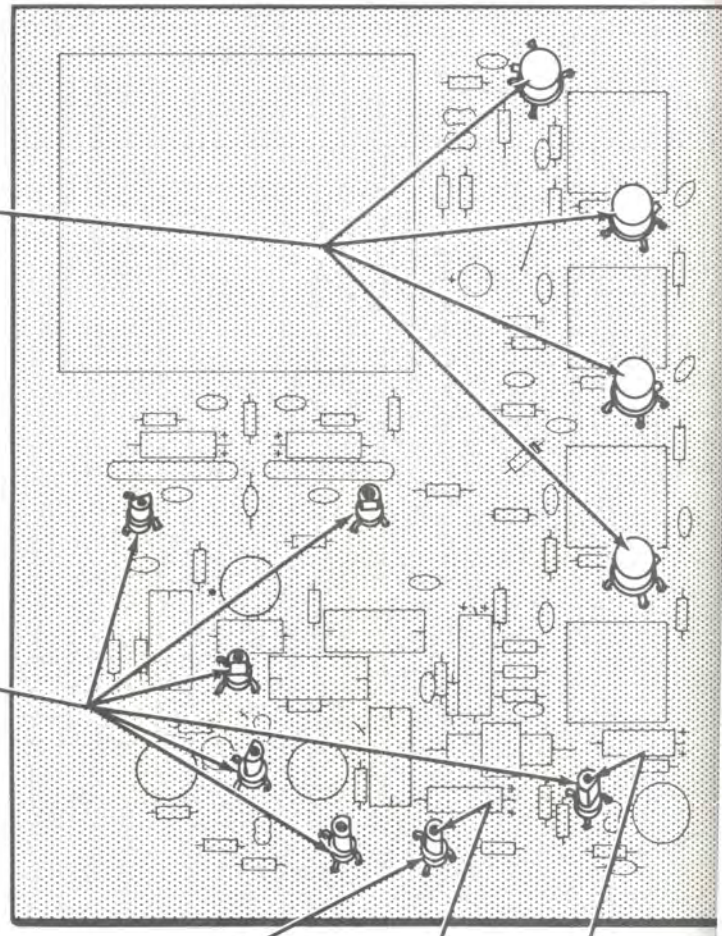
( ) 2N2654 transistors at Q4, Q5, Q6, and Q7. Position each transistor with its tab as shown. Mount each transistor with its body about 1/4" above the circuit board.



( ) 2N2712 orange dot transistors (#417-67) at Q8, Q9, Q10, Q11, Q12, and Q13. Install the transistors in the following manner, as shown. First line up the flat side of the transistor with the outline of the flat on the circuit board. Then insert the transistor leads into their correct holes which are indicated by E, C, and B. Mount each transistor about 1/4" above the circuit board.



( ) 2N2712 blue dot transistor (#417-77) at Q14. Position the flat side of the transistor as shown.



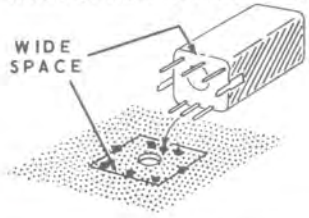
PROCEED TO PICTORIAL 6.

PICTORIAL 5

START

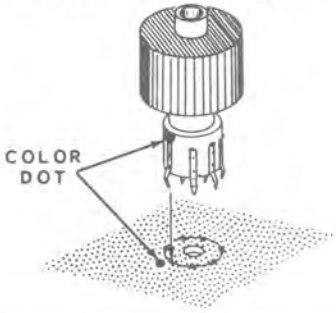
NOTE: Transformers and coils will be installed on the circuit board in the following steps. Solder the leads after each component is installed. It is not necessary to cut off the lugs after soldering.

( ) IF transformers (#52-81) at T3, T4, and T5. Match the side of the transformer that has the widely spaced pins with the wide-spaced holes of the circuit board.

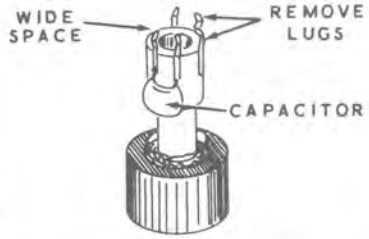


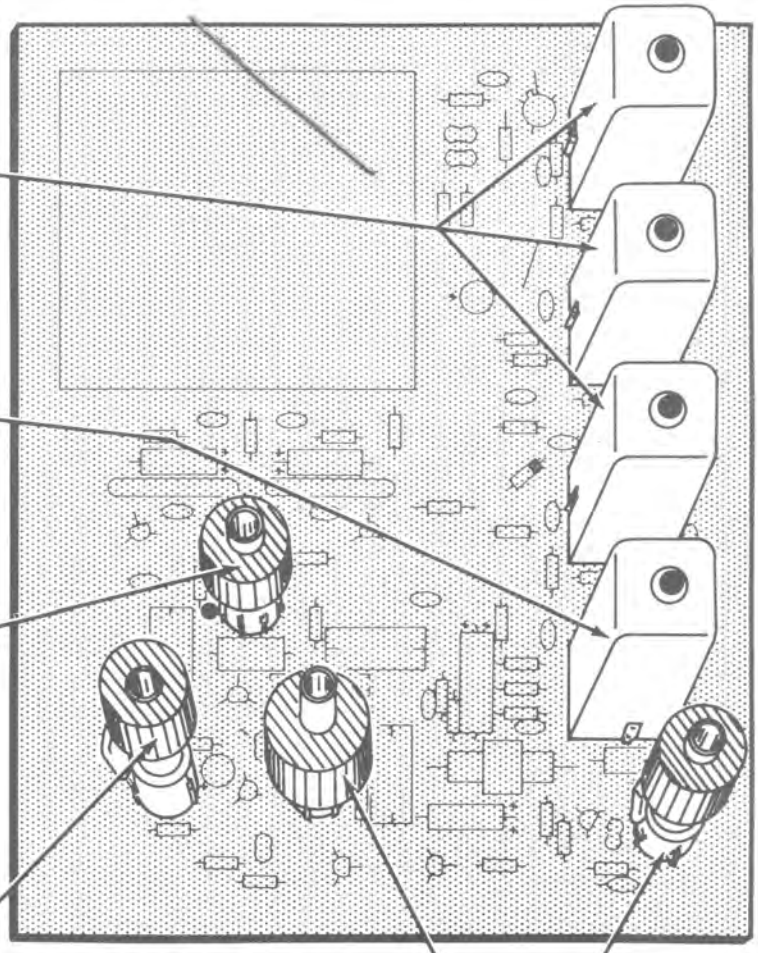
( ) Ratio detector transformer (#53-9) at T6. Insert the transformer pins with the wide spaces between them into the wide-spaced holes of the circuit board.

( ) 38 KC oscillator coil (#40-545) at T7. Position the coil with its color dot as shown.



( ) Remove two lugs from the 38 kc trap coil (#40-556) as shown. Then install this coil on the circuit board at L8.





CONTINUE

( ) 19 kc tank coil (#40-543) at L7.

( ) 67 kc trap coil (#40-697) at L6.

FINISH

Set the circuit board aside and proceed to Pictorial 7.

PICTORIAL 6

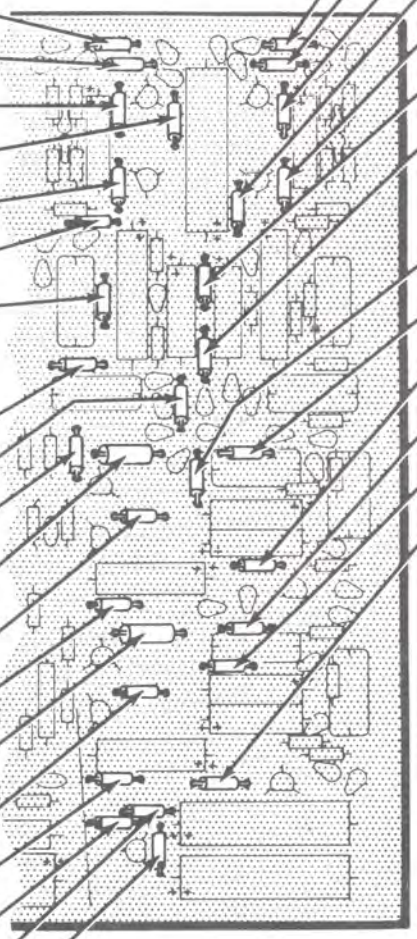
AMPLIFIER CIRCUIT BOARD (#85-137P240)

Position the circuit board on your work surface as shown in Pictorial 7.

START

NOTE: All resistors are 1/4 watt unless they are called out otherwise in the steps.

( ) 1000 Ω (brown-black-red).
( ) 390 Ω (orange-white-brown).
( ) 390 KΩ (orange-white-yellow).
( ) 56 KΩ (green-blue-orange).
( ) 100 Ω (brown-black-brown).
( ) 820 Ω (gray-red-brown).
( ) 10 KΩ (brown-black-orange).
( ) Solder all leads to the foil and cut off the excess lead lengths.
( ) 47 KΩ (yellow-violet-orange).
( ) 39 KΩ (orange-white-orange).
( ) 100 Ω (brown-black-brown).
( ) 1000 Ω (brown-black-red) 1/2 watt.
( ) 33 KΩ (orange-orange-orange).
( ) 6800 Ω (blue-gray-red).
( ) 1000 Ω (brown-black-red) 1/2 watt.
( ) 33 KΩ (orange-orange-orange).
( ) 6800 Ω (blue-gray-red).
( ) 6800 Ω (blue-gray-red).
( ) 47 KΩ (yellow-violet-orange).
( ) 820 Ω (gray-red-brown).
( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) 1000 Ω (brown-black-red).
( ) 390 Ω (orange-white-brown).
( ) 390 KΩ (orange-white-yellow).
( ) 56 KΩ (green-blue-orange).
( ) 100 Ω (brown-black-brown).
( ) 1500 Ω (brown-green-red).
( ) 39 KΩ (orange-white-orange).
( ) Solder all leads to the foil and cut off the excess lead lengths.
( ) 5600 Ω (green-blue-red).
( ) 5600 Ω (green-blue-red).
( ) 6800 Ω (blue-gray-red).
( ) 5600 Ω (green-blue-red).
( ) 5600 Ω (green-blue-red).
( ) 6800 Ω (blue-gray-red).
( ) Solder all leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 8.

PICTORIAL 7

START

NOTE: All resistors are 1/4 watt unless they are called out otherwise in the steps.

( ) 180 KΩ (brown-gray-yellow).

( ) 180 KΩ (brown-gray-yellow).

( ) 4700 Ω (yellow-violet-red).

( ) 4700 Ω (yellow-violet-red).

( ) 56 KΩ (green-blue-orange).

( ) 15 KΩ (brown-green-orange).

( ) 2200 Ω (red-red-red).

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 560 Ω (green-blue-brown).

( ) 560 Ω (green-blue-brown).

( ) 100 KΩ (brown-black-yellow).

( ) 100 KΩ (brown-black-yellow).

( ) 2200 Ω (red-red-red).

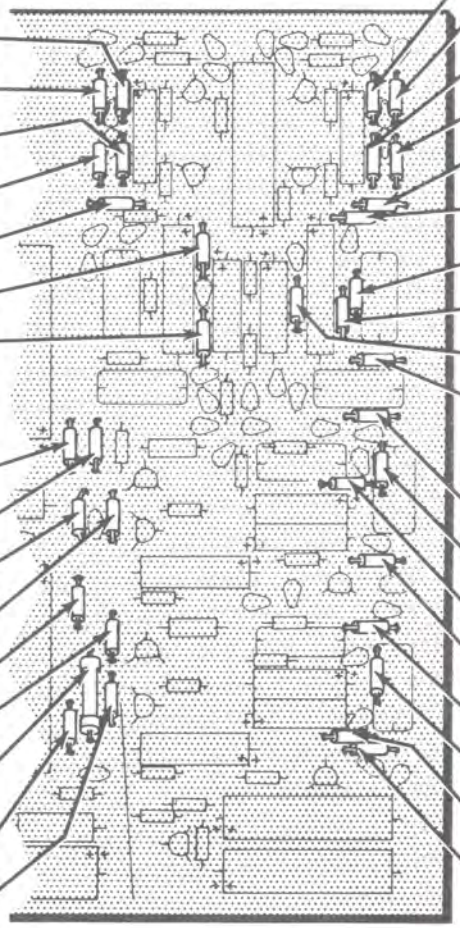
( ) 100 Ω (brown-black-brown).

( ) 91 Ω (white-brown-black) low-noise.

( ) 560 Ω (green-blue-brown).

( ) 100 KΩ (brown-black-yellow).

( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) 180 KΩ (brown-gray-yellow).

( ) 180 KΩ (brown-gray-yellow).

( ) 4700 Ω (yellow-violet-red).

( ) 4700 Ω (yellow-violet-red).

( ) 56 KΩ (green-blue-orange).

( ) 820 Ω (gray-red-brown).

( ) 10 KΩ (brown-black-orange).

( ) 15 KΩ (brown-green-orange).

( ) 2200 Ω (red-red-red).

( ) 47 KΩ (yellow-violet-orange).

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 5600 Ω (green-blue-red).

( ) 5600 Ω (green-blue-red).

( ) 39 KΩ (orange-white-orange).

( ) 100 KΩ (brown-black-yellow).

( ) 5600 Ω (green-blue-red).

( ) 5600 Ω (green-blue-red).

( ) 39 KΩ (orange-white-orange).

( ) 100 KΩ (brown-black-yellow).

( ) Solder all leads to the foil and cut off the excess lead lengths.

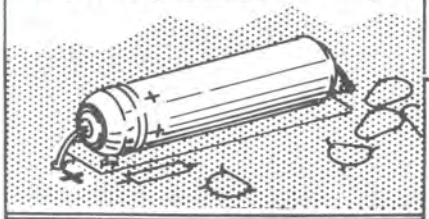
PROCEED TO PICTORIAL 9.

PICTORIAL 8

START

NOTE: When installing electrolytic capacitors, position the positive (+) marked end of the capacitor over the positive (+) mark lettered on the circuit board.

( ) 100 µfd, 30 volt electrolytic.



( ) 10 µfd, 10 volt electrolytic.

( ) 100 µfd, 3 volt electrolytic.

( ) .0068 µfd resin.

( ) 10 µfd, 15 or 20 volt electrolytic.

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) .0022 µfd resin.

( ) 10 µµf disc.

( ) 10 µfd, 10 volt electrolytic.

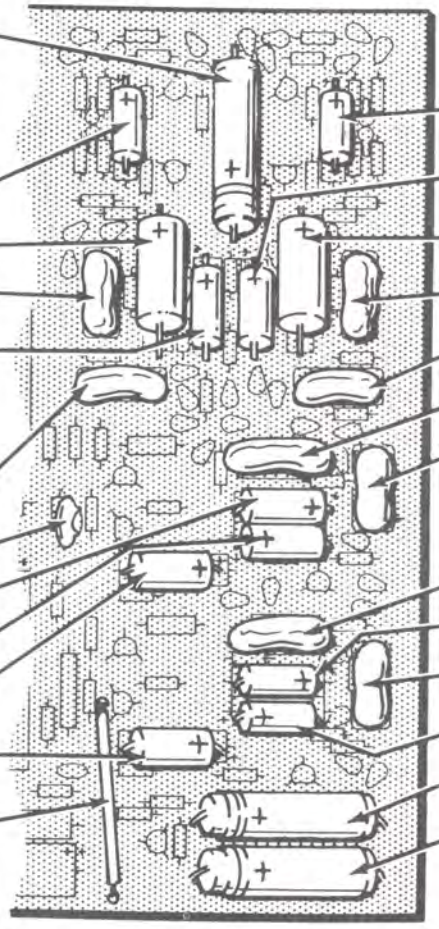
( ) 10 µfd, 10 volt electrolytic.

( ) 2 µfd, 25 volt electrolytic.

( ) 2 µfd, 25 volt electrolytic.

( ) 2" jumper wire. Use a length of brown wire with a 1/4" of insulation removed from each end.

( ) Solder all leads to the foil and cut off the excess lead length.



CONTINUE

( ) 10 µfd, 10 volt electrolytic.

( ) 10 µfd, 15 or 20 volt electrolytic.

( ) 100 µfd, 3 volt electrolytic.

( ) .0068 µfd resin.

( ) .0022 µfd resin.

( ) .047 µfd resin.

( ) .0022 µfd resin.

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) .047 µfd resin.

( ) 10 µfd, 10 volt electrolytic.

( ) .0022 µfd resin.

( ) 10 µfd, 10 volt electrolytic.

( ) 100 µfd, 30 volt electrolytic.

( ) 100 µfd, 30 volt electrolytic.

( ) Solder all leads to the foil and cut off the excess lead lengths.

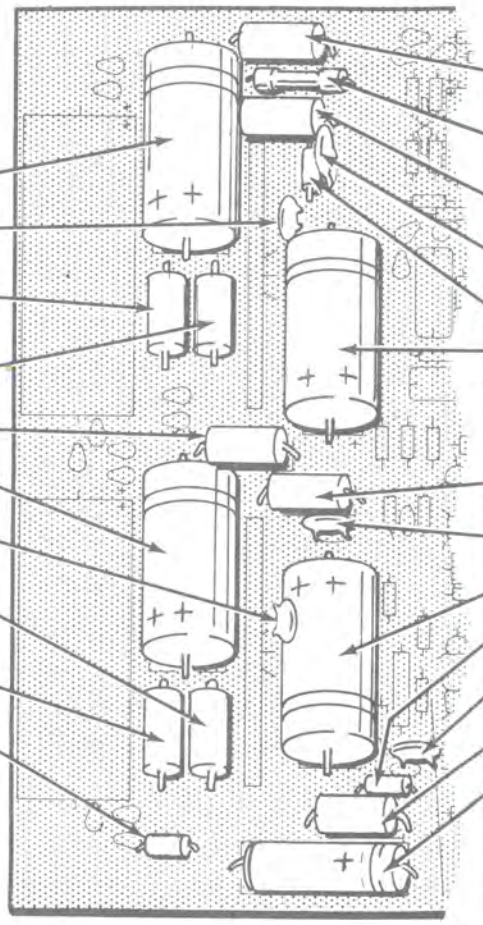
FINISH

PROCEED TO PICTORIAL 10.

PICTORIAL 9

START

- (✓) 500 µfd, 15 volt electrolytic.
- (✓) .005 µfd disc.
- (✓) 150 Ω (brown-green-brown) 1 watt.
- (✓) 150 Ω (brown-green-brown) 1 watt.
- (✓) 1 Ω (brown-black-gold) 2 watt.
- (✓) 500 µfd, 15 volt electrolytic.
- (✓) .005 µfd disc.
- (✓) 150 Ω (brown-green-brown) 1 watt.
- (✓) 150 Ω (brown-green-brown) 1 watt.
- (✓) 560 Ω (green-blue-brown).
- ( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

- (✓) 1 Ω (brown-black-gold) 2 watt.
- (✓) 91 Ω (white-brown-black) low noise.
- (✓) 1 Ω (brown-black-gold) 2 watt.
- (✓) .002 µfd disc.
- (✓) 2200 Ω (red-red-red).
- (✓) 500 µfd, 15 volt electrolytic.
- ( ) Solder all leads to the foil and cut off the excess lead lengths.
- (✓) 1 Ω (brown-black-gold) 2 watt.
- (✓) .002 µfd disc.
- (✓) 500 µfd, 15 volt electrolytic.
- (✓) 100 KΩ (brown-black-yellow).
- (✓) 10 µµf disc.
- (✓) 270 Ω (red-violet-brown) 1 watt.
- (✓) 100 µfd, 30 volt electrolytic.
- ( ) Solder all leads to the foil and cut off the excess lead lengths.

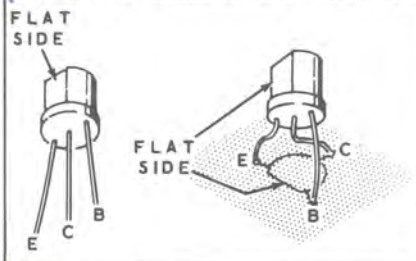
PROCEED TO PICTORIAL 11.

PICTORIAL 10

START

Install the transistors on the lettered side of the circuit board as shown. Solder all three transistor leads to the foil after each transistor is installed. Cut off the excess lead lengths close to the foil.

( ) 2N3391 transistors at Q1 and Q2.



( ) 2N2712 transistors at Q3 and Q4.

( ) 2N3416 transistor at Q9.

( ) 2N2712 transistor at Q7.

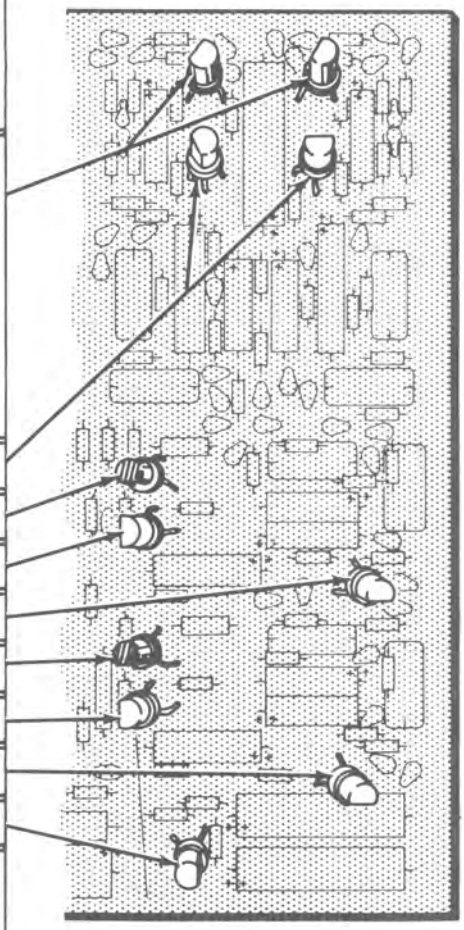
( ) 2N2712 transistor at Q5.

( ) 2N3416 transistor at Q10.

( ) 2N2712 transistor at Q8.

( ) 2N2712 transistor at Q6.

( ) 2N2712 transistor at Q100.



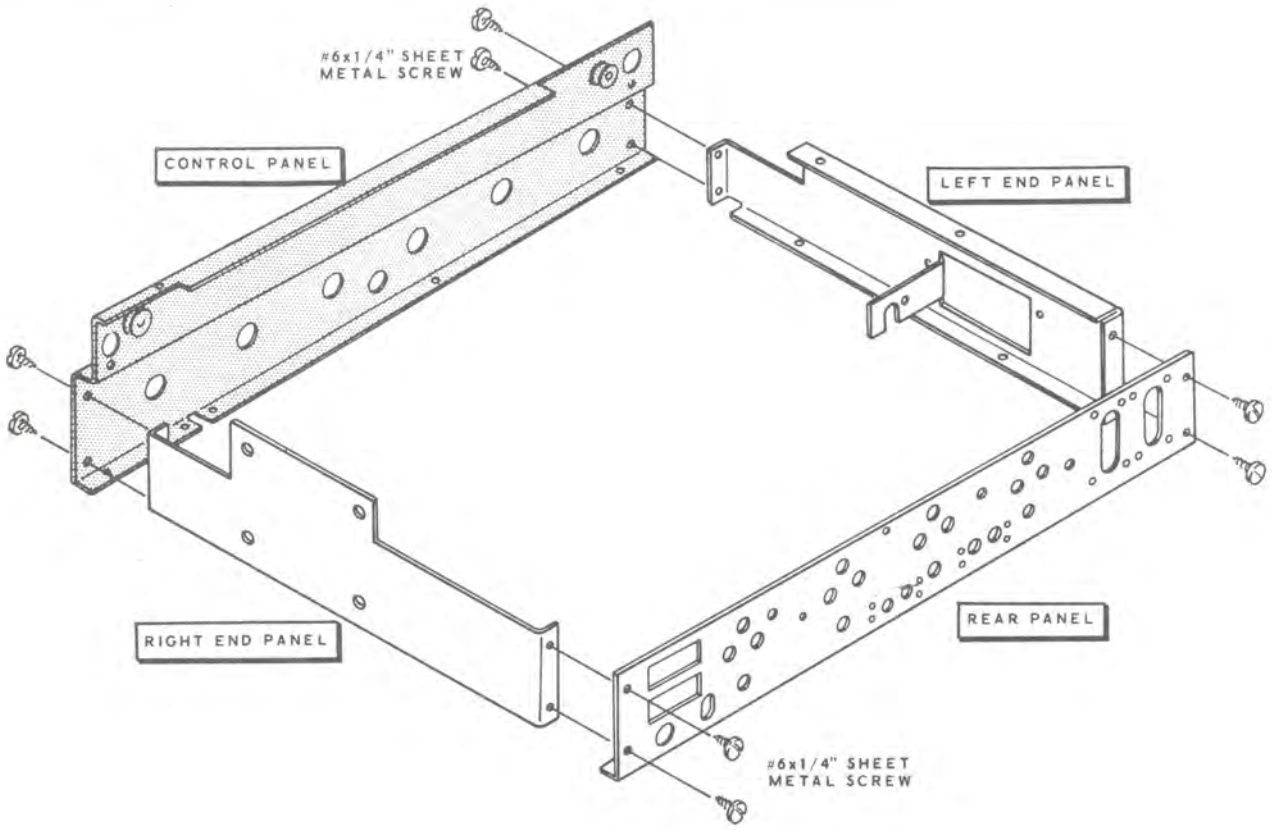
NOTE: All components on the amplifier circuit board should now be installed and soldered to the foil, except two 2500 μfd electrolytic capacitors and transistors Q11 and Q12. These parts will be installed later.

( ) Set the circuit board aside temporarily.

FINISH

PROCEED TO PAGE 17 FOR CHASSIS PARTS MOUNTING.

PICTORIAL 11



PICTORIAL 12

MOUNTING CHASSIS PARTS

Refer to Pictorial 12 for the following steps.

( ) Locate the control panel, rear panel, left end panel, and right end panel.

( ) Mount the left end panel to the control panel with two #6 x 1/4" sheet metal screws.

( ) Mount the right end panel to the control panel with two #6 x 1/4" sheet metal screws.

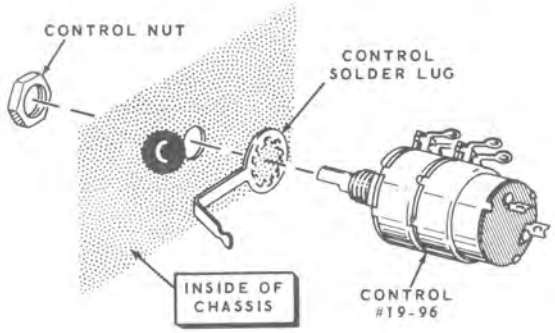
( ) Fasten the rear panel to the right and left end panels with four #6 x 1/4" sheet metal screws.

Refer to Pictorial 13 (fold-out from Page 19) for the following steps.

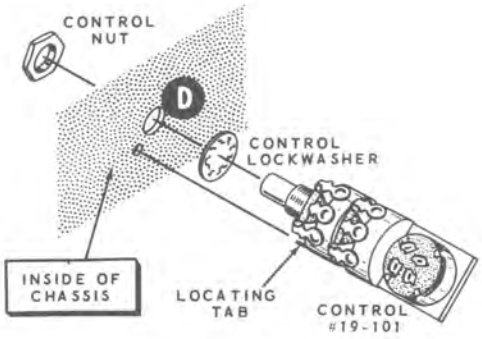
( ) Turn the chassis over and position it as shown.

NOTE: Be sure to mount each of the following controls with its lugs positioned as shown in the Pictorial.

( ) Mount a dual control (#19-96) at C with a control solder lug and a control nut. See Detail 13A. Position the solder lug as shown.



Detail 13A



Detail 13B

( ) Mount a dual control (#19-101) at D with a control lockwasher and control nut. Insert the locating tab into the small hole in the panel. See Detail 13B.

( ) Mount a dual control (#12-66) at F with a control lockwasher and control nut.

( ) Mount a control (#19-97) at G with a control lockwasher and control nut.

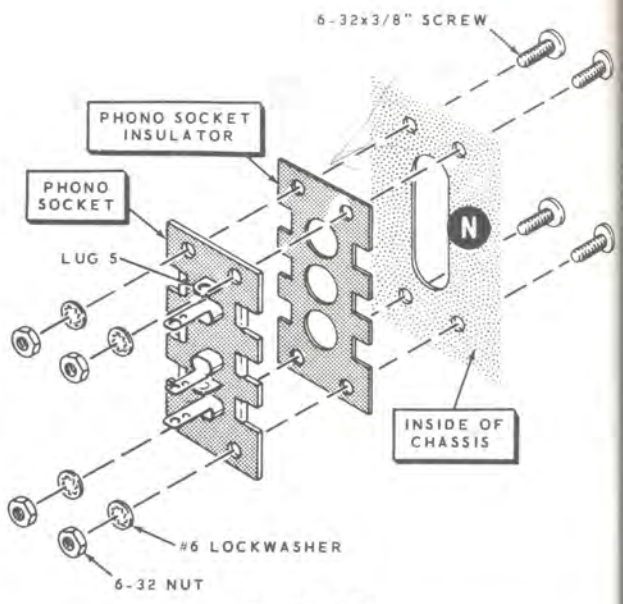
( ) Mount bushings at B and H with control lockwashers and control nuts.

NOTE: Use the plastic nut starter for picking up and starting nuts on the screw threads.

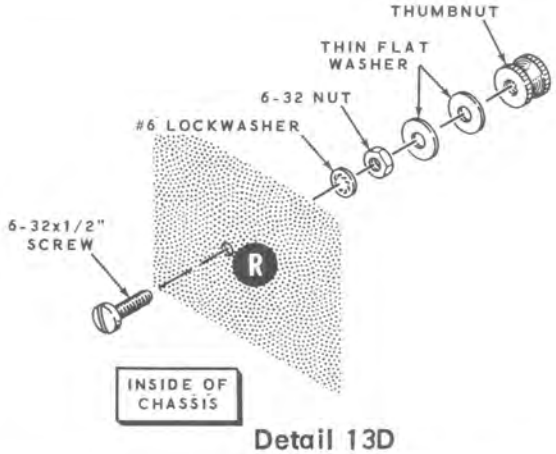
( ) Refer to Detail 13C and place a phono socket insulator on the indicated side of each phono socket. Then mount one phono socket at N and another one at P. Make sure lug 5 of the socket is positioned as shown in Pictorial 13. Use 6-32 x 3/8" screws, #6 lockwashers, and 6-32 nuts.

( ) Mount a 6-32 x 1/2" screw at R with a #6 lockwasher, and a 6-32 nut. Then place two thin flat washers and a thumbnut on the screw. Tighten the thumbnut finger tight only. See Detail 13D.

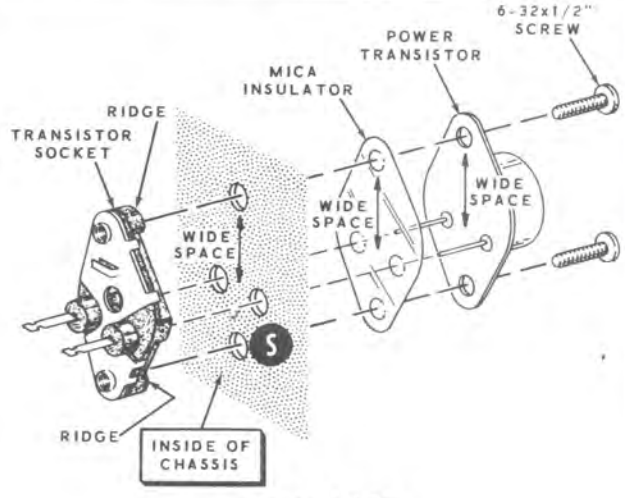
NOTE: Four transistors will be mounted with their insulators and sockets in the following steps. Before mounting, make sure the indicated wide space on each transistor, transistor socket and mica insulator is lined up with the wide space on the chassis. Also, make sure the ridges on the sockets seat properly in the chassis mounting holes. See Detail 13E.



Detail 13C



Detail 13D

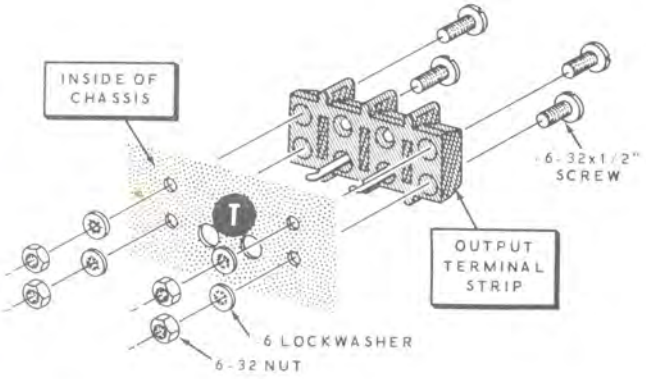


Detail 13E

(✓) Place the four mica insulators on a piece of paper on your work surface. Then apply a thin film of silicone grease on both sides of each insulator with the tip of your finger.

(✓) Refer to Detail 13E and mount 2N2148 transistors (#417-99), mica insulators, and transistor sockets at S and Z. Use 6-32 x 1/2" screws.

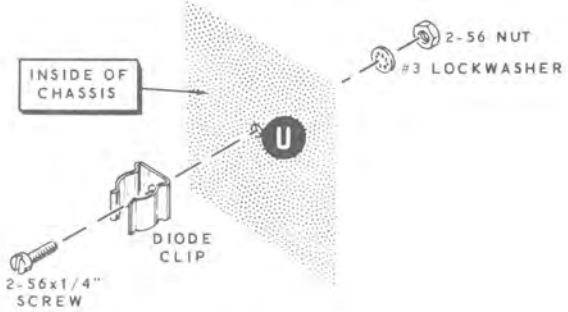
( ) Similarly mount TA2577A transistors (#417-101), mica insulators, and transistor sockets at X and AB. Use 6-32 x 1/2" screws.



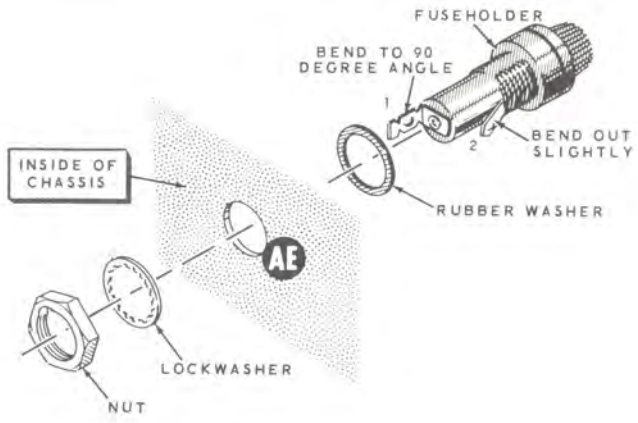
Detail 13F

(✓) Refer to Detail 13F and mount output terminal strips at T and Y with 6-32 x 1/2" screws.

(✓) Refer to Detail 13G and mount diode clips at U and AA. Use 2-56 x 1/4" screws, #3 lockwashers and 2-56 nuts.



Detail 13G

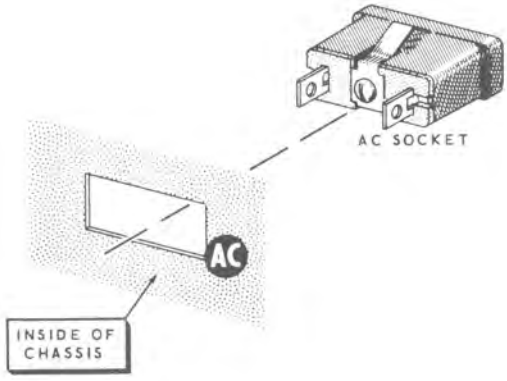


Detail 13H

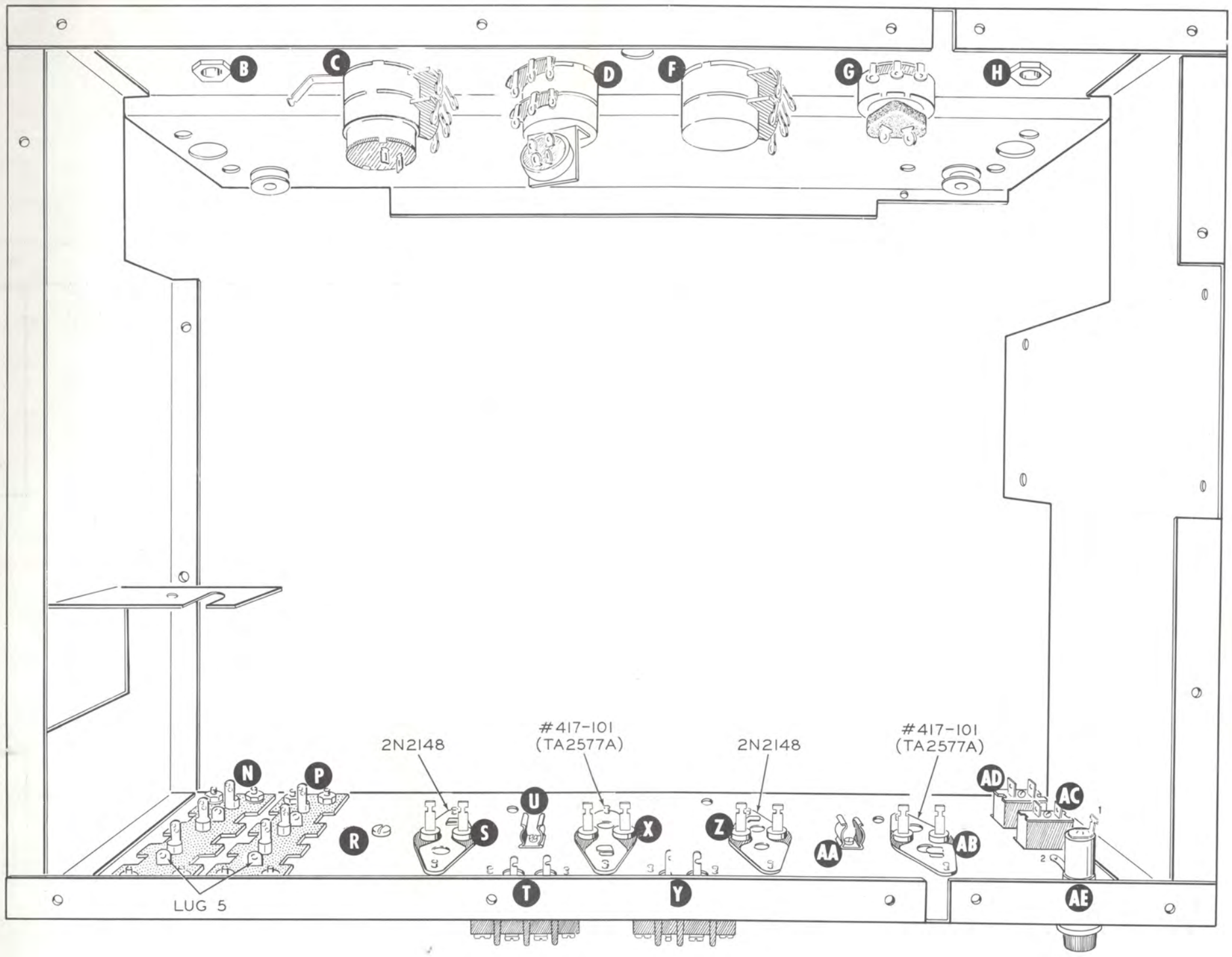
( ) Locate the fuseholder and bend lugs 1 and 2 as shown in Detail 13H.

( ) Mount the fuseholder at AE. Use the rubber washer, lockwasher and nut provided. See Detail 13H.

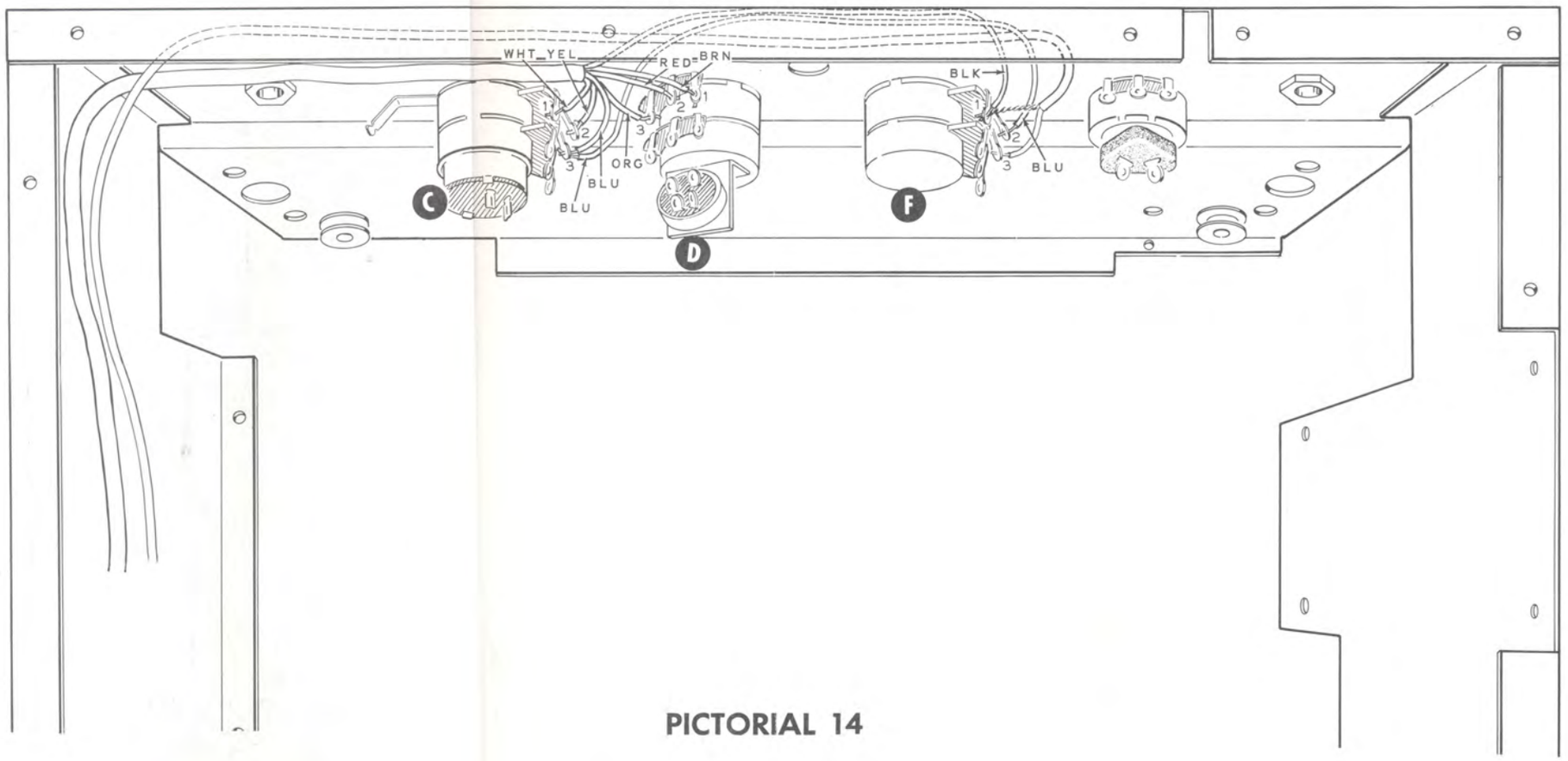
( ) Mount AC sockets at locations AD and AC. Push on each socket until it snaps into place. See Detail 13J.



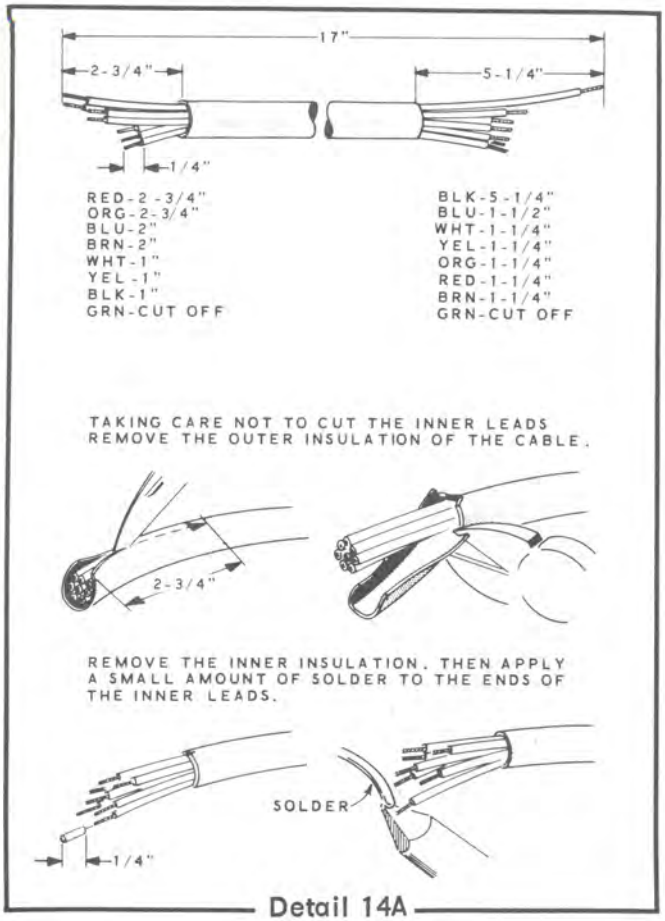
Detail 13J



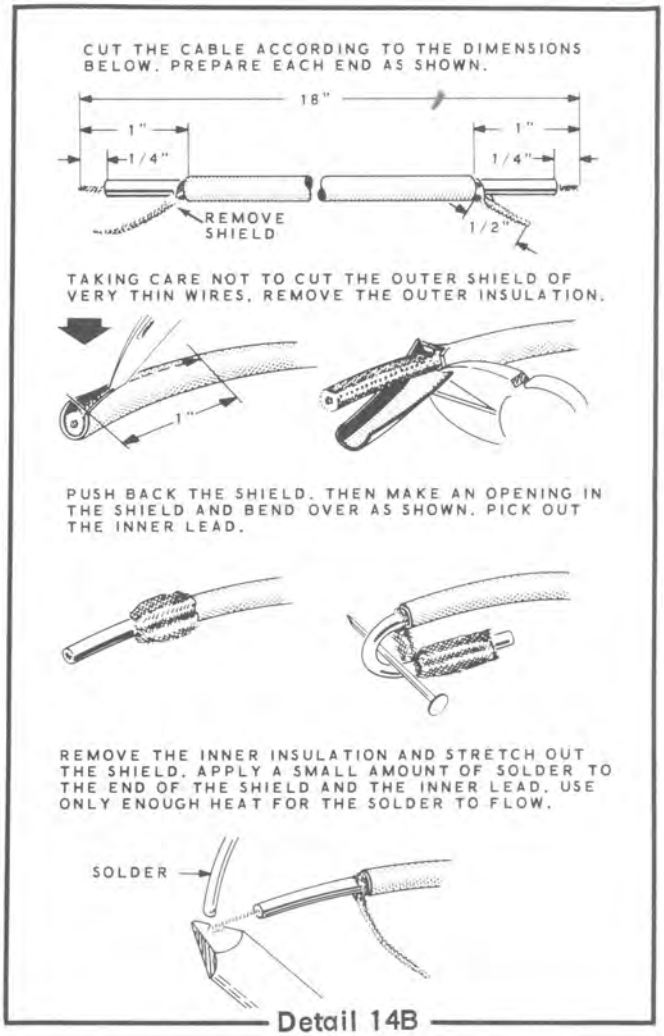
PICTORIAL 13



PICTORIAL 14



Detail 14A



Detail 14B

PRELIMINARY WIRING

Refer to Pictorial 14 for the following steps.

( ) Refer to Detail 14A and prepare a 17" length of 8-wire cable as shown.

Connect the end of the cable, with the long black wire, as follows:

( ) White to lug 1 of control C (S-1).

( ) Yellow to lug 2 of control C (S-1).

( ) Blue to lug 3 of control C (NS).

( ) Brown to lug 1 of control D (S-1).

( ) Red to lug 2 of control D (S-1).

( ) Orange to lug 3 of control D (S-1).

( ) Black to lug 1 of control F (NS).

The other end of the cable will be connected later.

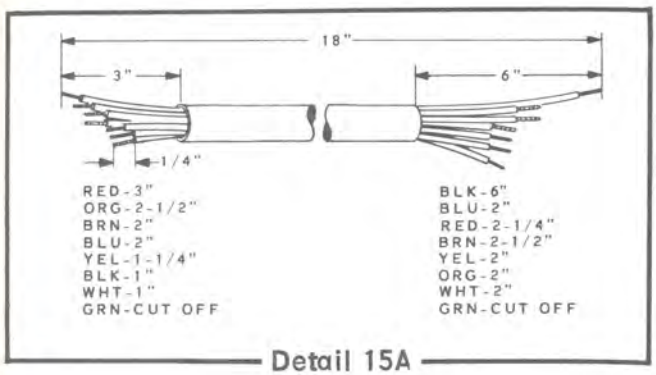
( ) Connect a 6" blue hookup wire from lug 3 of control C (S-2) to lug 2 of control F (S-1).

( ) Prepare two 18" lengths of coaxial cable as shown in Detail 14B.

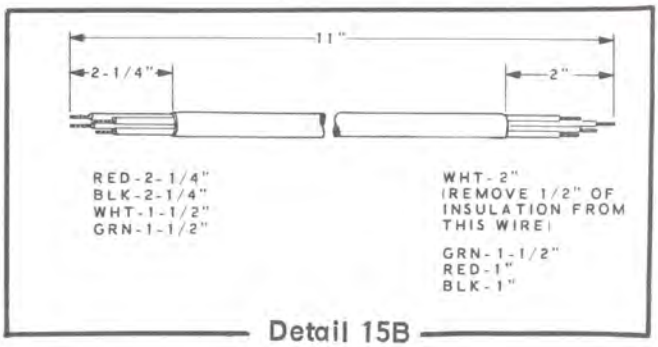
( ) Set one cable aside temporarily.

( ) Connect the inner lead of one cable (the end with the short shield) to lug 3 (S-1) and the shield to lug 1 (S-2) of control F.

The other end of the cable will be connected later.



Detail 15A



Detail 15B

Refer to Pictorial 15 (fold-out from Page 23) for the following steps.

( ) Prepare an 18" 8-wire cable as shown in Detail 15A.

Connect the end of the cable, with the long black wire, as follows:

( ) White to lug 4 of control C (S-1).

( ) Yellow to lug 5 of control C (S-1).

( ) Blue to lug 6 of control C (NS).

( ) Brown to lug 4 of control D (S-1).

( ) Red to lug 5 of control D (S-1).

( ) Orange to lug 6 of control D (S-1).

( ) Black to lug 4 of control F (NS).

The other end of the cable will be connected later.

( ) Connect a 6" blue hookup wire from lug 5 of control F (S-1) to lug 6 of control C (S-2).

( ) Locate the previously prepared coaxial cable.

( ) Connect the center lead of the coaxial cable (at the end with the short shield) to lug 6 (S-1), and the shield to lug 4 (S-2) of control F. The other end of the cable will be connected later.

( ) Prepare an 11" length of 4-conductor cable as shown in Detail 15B.

Connect the end of this 11" cable, with the short red and black wires, as follows:

( ) Red to lug 4 of control G (S-1).

( ) Black to lug 5 of control G (S-1).

( ) Green to lug 1 of control G (S-1).

NOTE: Where a wire passes through a connection and then goes to another point, it will count as two wires, one entering and one leaving the connection.

( ) White through lug 2 (S-2) to lug 3 of control G (S-1).

( ) Fasten the loose ends of the cables to the end panel with a piece of solder. This will keep them out of your way while performing the following steps.

When wiring this kit, you may wish to prepare the lengths of hookup wire ahead of time, as in the next step. Prepare each wire by cutting it to the specified length, and stripping 1/4" of insulation from each end. Arrange the wires in sequence listed. This will save time in performing the wiring steps.

( ) Prepare the following lengths of white hookup wire:

1-3/4"
1-3/4"
1-3/4"

( ) Connect a 1-3/4" white wire between lugs 2 (NS) and 5 (NS) of phono socket N.

( ) Connect a 1-3/4" white wire between lugs 2 (S-1) and 5 (NS) of phono socket P.

( ) Connect a 1-3/4" white wire from lug 5 of phono socket N (S-2) to lug 5 of phono socket P (S-2).

NOTE: Black stranded hookup wire will be used in several of the following steps. Remove 1/4" of insulation from the ends of each of these wires, then apply a small amount of solder to hold the small wire strands together. Form a small hook at each end of each wire.

( ) Prepare the following lengths of green hookup wire and black stranded wire:

3-3/4" green hookup
3" green hookup
8-1/2" black stranded
1-1/4" black stranded
1-1/4" black stranded

( ) Connect a 3-3/4" green wire from lug 3 of socket S (NS) to lug 2 of terminal strip T (S-1).

( ) Connect a 3" green wire from lug 2 of terminal strip Y (S-1) to lug 3 of socket Z (NS).

( ) Connect an 8-1/2" black stranded wire from lug 3 of socket S (S-2) to lug 3 of socket Z (NS).

( ) Connect a 1-1/4" black stranded wire from lug 2 of socket AC (NS) to lug 2 of socket AD (NS).

( ) Connect a 1-1/4" black stranded wire from lug 1 of socket AC (NS) to lug 2 of fuseholder AE (S-1).

NOTE: THE #56-33/1N3754 diodes will be installed in the following steps. Be sure to position the lead with the color dot next to it, as shown in the Pictorial. Also, do not shorten the leads of either diode.

( ) Install one of the #56-33/1N3754 diodes in clip U and install the other 1N3754 diode in clip AA. Slip a 1" length of sleeving on each of the diode leads, then form a small hook at the end of each lead.

( ) Connect the lead near the color dot of diode U to lug 2 of socket S (NS). Connect the other lead to lug 1 of socket X (NS).

( ) Connect the lead near the color dot of diode AA to lug 2 of socket Z (NS). Connect the other lead to lug 1 of socket AB (NS).

MOUNTING POWER SUPPLY CHASSIS, CENTER PANEL, AND FLYWHEEL

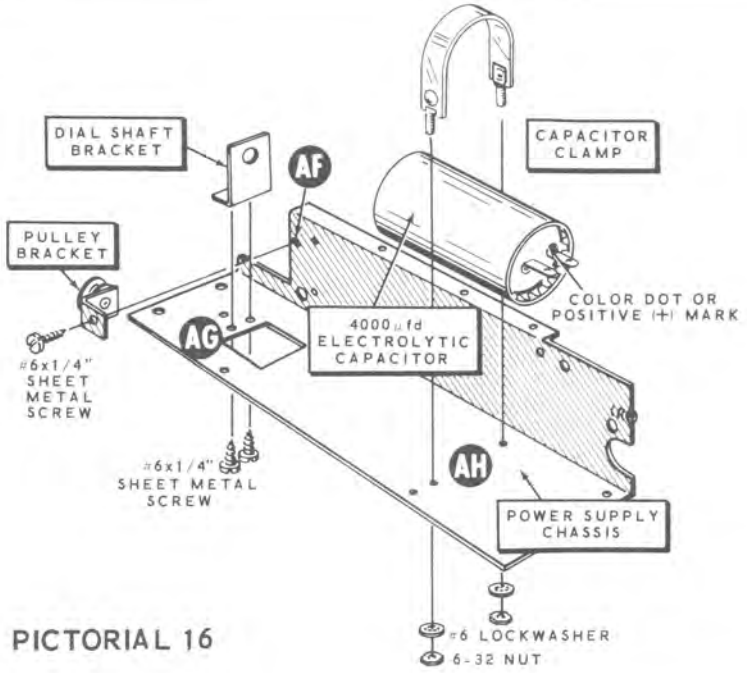
Refer to Pictorial 16 for the following steps.

( ) Locate the power supply chassis, pulley bracket, dial shaft bracket, capacitor clamp, and the 4000 μfd electrolytic capacitor.

( ) Mount the pulley bracket at AF with a #6 x 1/4" sheet metal screw.

( ) Mount the dial shaft bracket at AG with #6 x 1/4" sheet metal screws.

( ) Bend the capacitor clamp in the shape of a U and mount it at AH. Use #6 lockwashers and 6-32 nuts but do not tighten the nuts at this time.



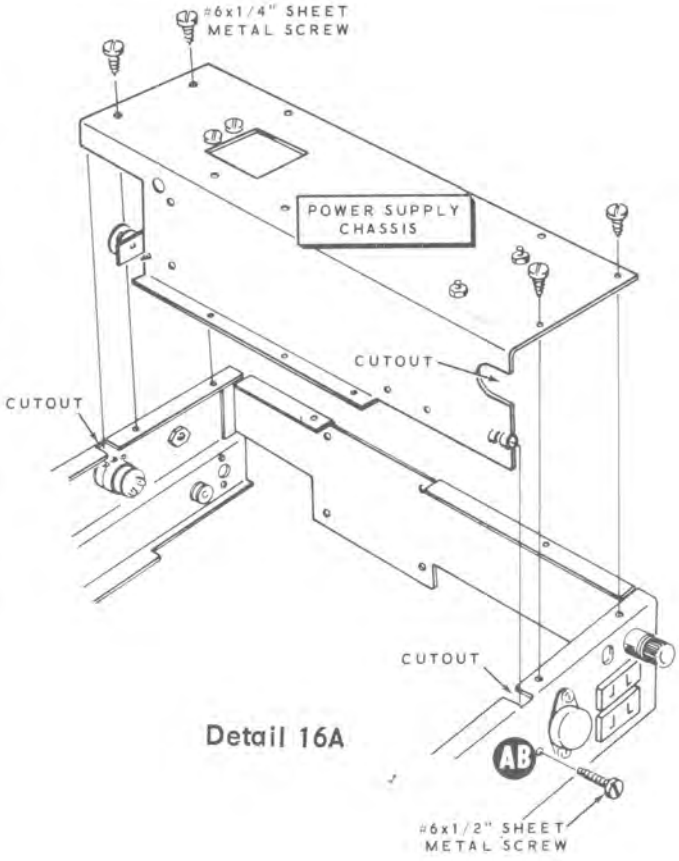
PICTORIAL 16

( ) Slide the 4000 µfd electrolytic capacitor under the clamp. Position the capacitor so the clamp is approximately in the middle of the case. Then turn the capacitor until the color dot or positive (+) marked lug is positioned as shown. Now tighten the nuts on the capacitor clamp.

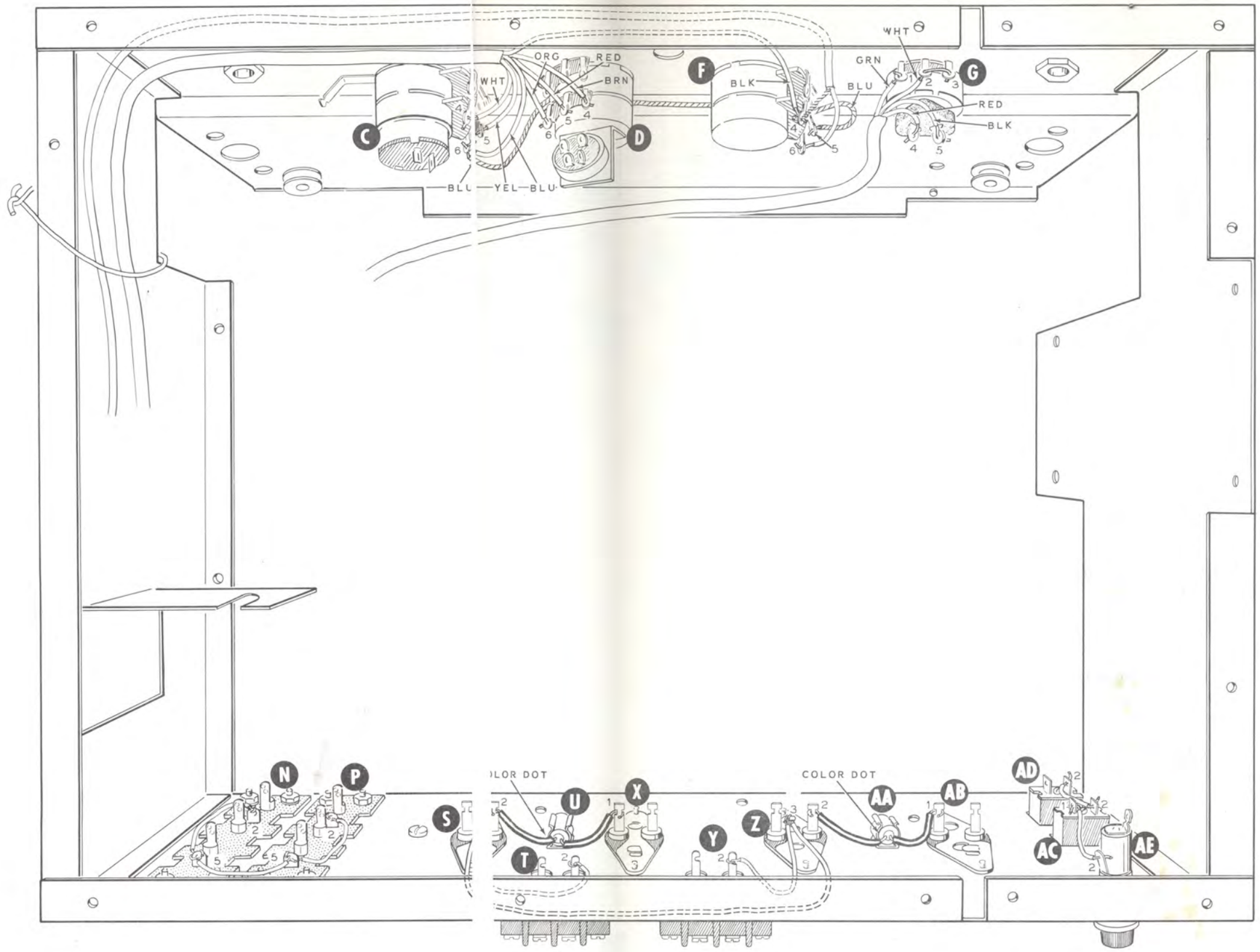
Refer to Detail 16A for the following steps.

( ) Insert the power supply chassis through the cutouts in the control panel and rear panel. Also, make sure the diode lead going to transistor AB is routed through the cutout in the power supply chassis and is not pinched between the chassis and the rear panel.

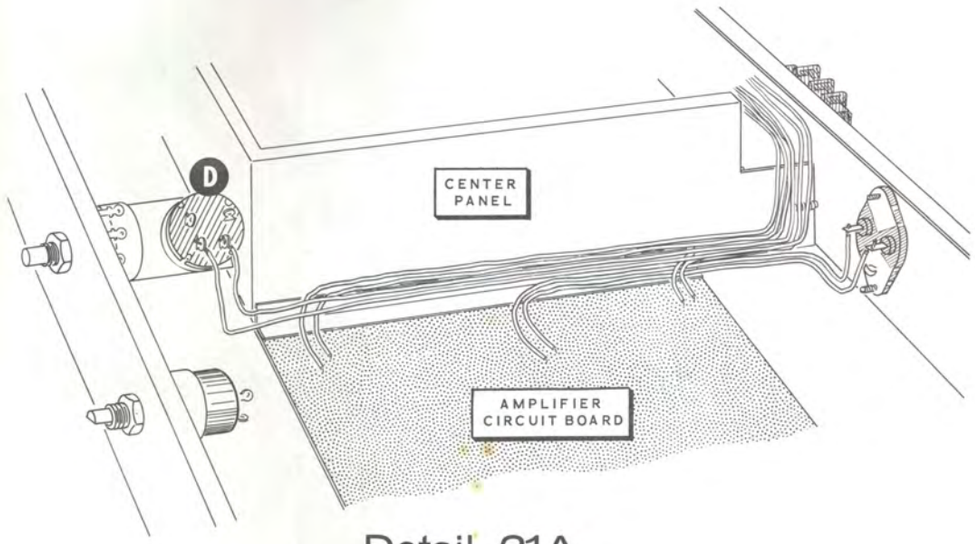
( ) Fasten the power supply chassis to the control and rear panels with four #6 x 1/4" sheet metal screws and one #6 x 1/2" sheet metal screw.



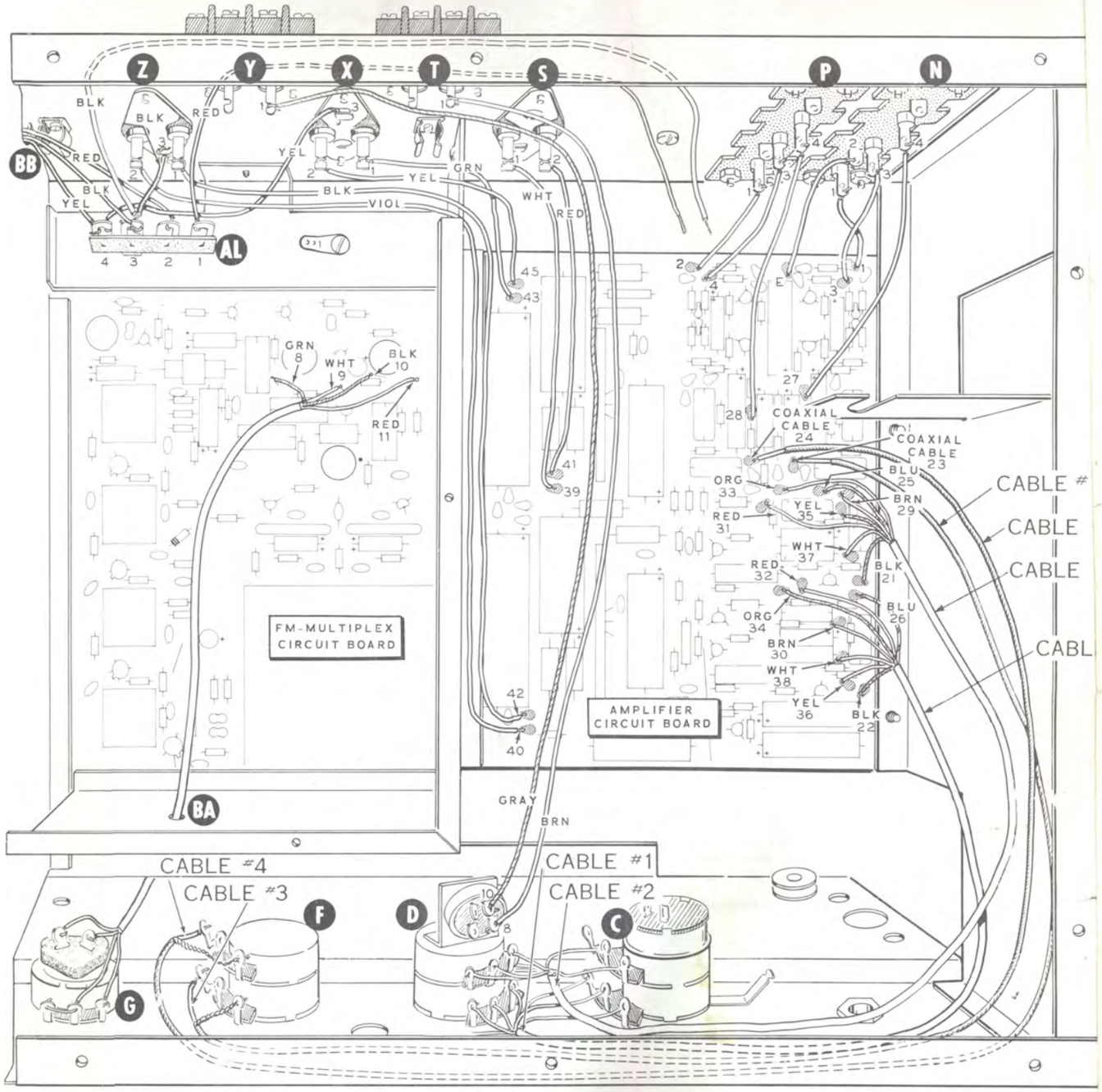
Detail 16A



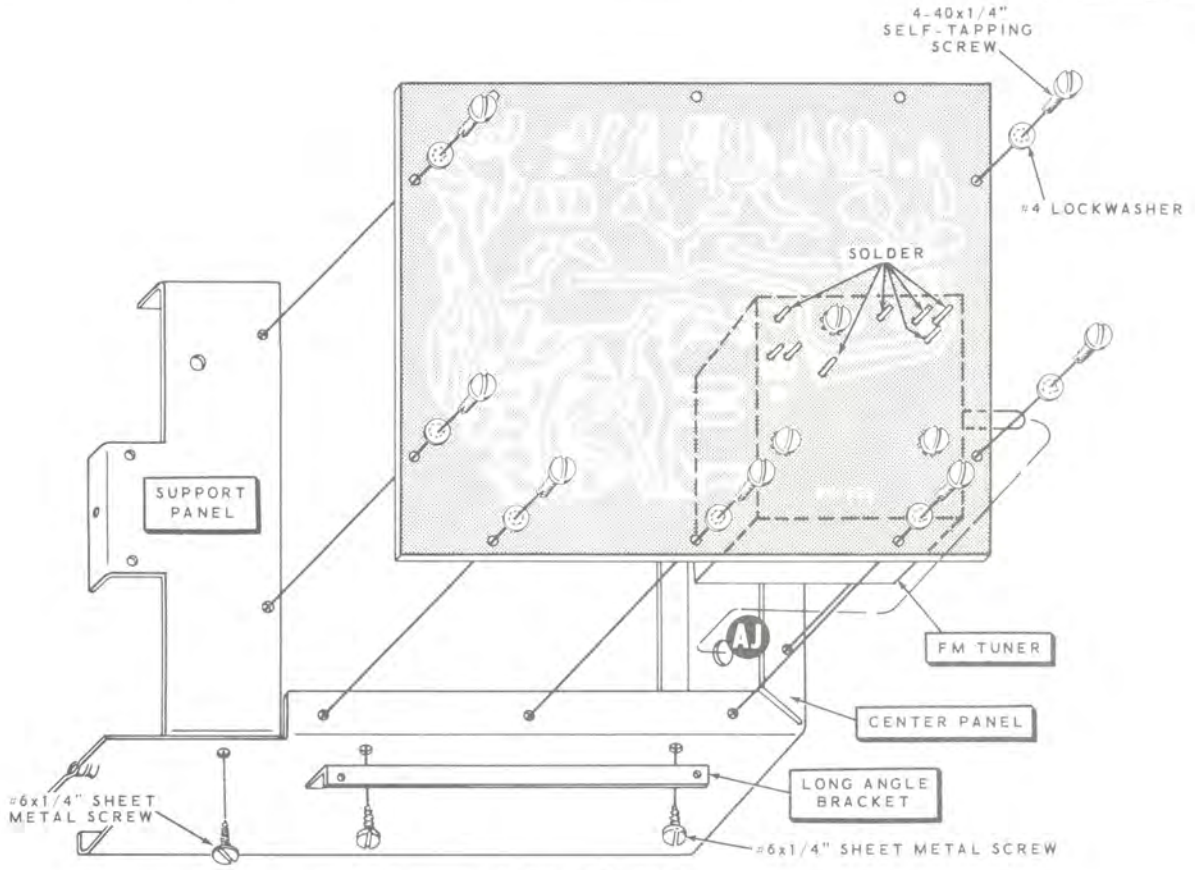
PICTORIAL 15



Detail 21A



PICTORIAL 21



PICTORIAL 17

Refer to Pictorial 17 for the following steps.

( ) Locate the center panel, long angle bracket, support panel, circuit board (#85-125P208), and FM tuner.

( ) Mount the long angle bracket to the center panel with #6 x 1/4" sheet metal screws.

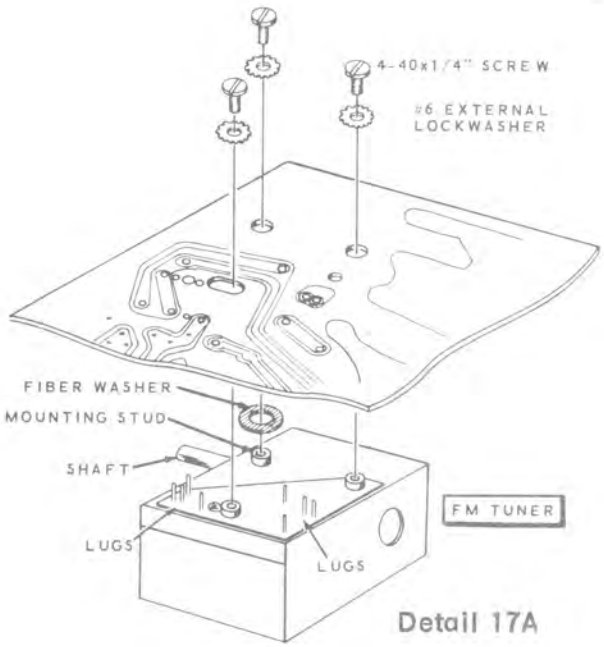
( ) Mount the support panel to the center panel with one #6 x 1/4" sheet metal screw.

( ) Position the fiber washer over the indicated mounting stud on the FM tuner. See Detail 17A.

NOTE: Handle the circuit board carefully in the following steps, so the coils are not damaged.

( ) Refer to Detail 17A and mount the FM tuner on the circuit board as follows: First, insert the three mounting studs and eight lugs of the tuner into the indicated holes in the circuit board. Then fasten the tuner to the board with 4-40 x 1/4" screws and #6 external lockwashers.

( ) Solder the six indicated lugs of the tuner to the foil side of the circuit board. Do not cut off any of the lugs after soldering.



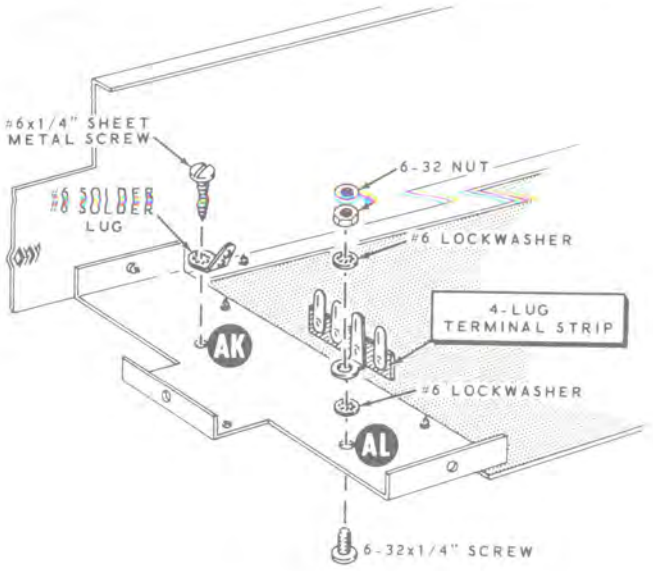
Detail 17A

( ) Mount the circuit board to the center panel by inserting the tuner shaft through hole AJ. Then fasten the circuit board to the center panel and support panel with seven 4-40 x 1/4" self-tapping screws and #4 lockwashers. Be careful not to overtighten these screws; this could strip the threads in the panels.

Refer to Detail 17B for the following steps.

( ) Turn the assembly over and mount a #6 solder lug at AK. Use a #6 x 1/4" sheet metal screw.

( ) Mount a 4-lug terminal strip at AL with a 6-32 x 1/4" screw, two #6 lockwashers, and a 6-32 nut.



Detail 17B

Refer to Detail 17C for the following steps.

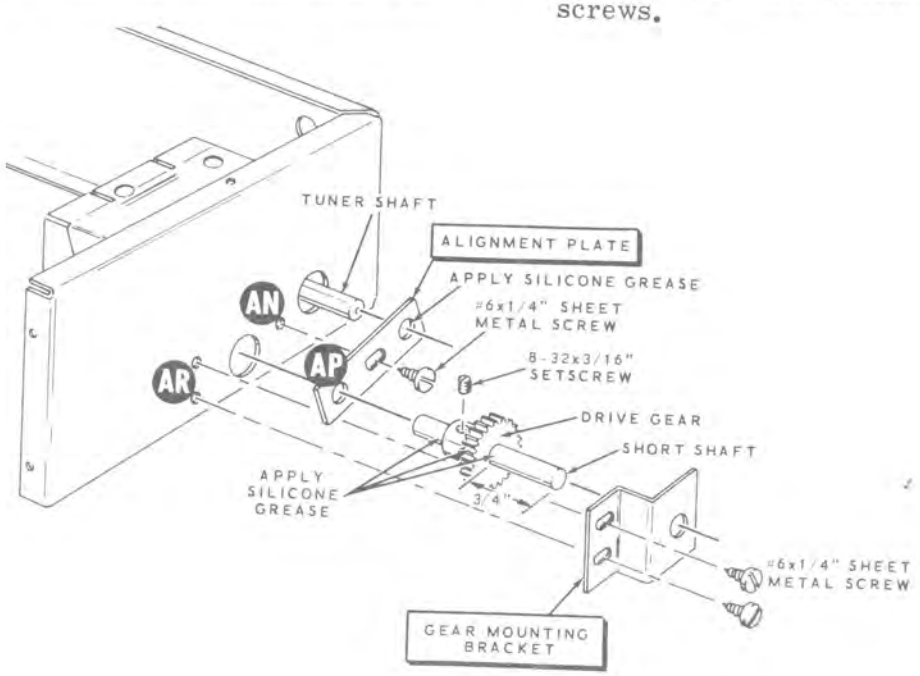
( ) Locate the alignment plate, gear mounting bracket, short shaft, and drive gear.

( ) Position the alignment plate over the tuner shaft. Then fasten it at AN with a #6 x 1/4" sheet metal screw.

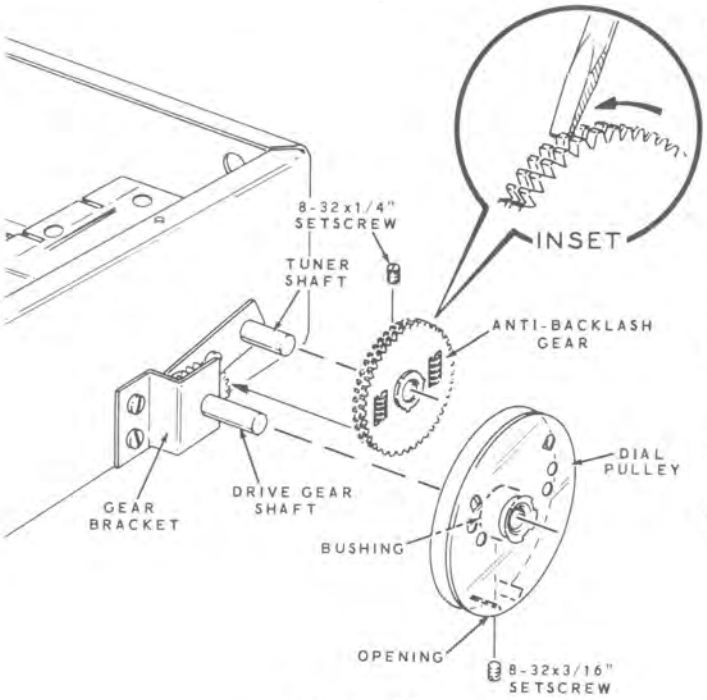
( ) Start an 8-32 x 3/16" setscrew in the drive gear. Then slide the gear onto the shaft. Position the gear 3/4" from the end of the shaft and tighten the setscrew.

( ) Apply a small amount of silicone grease to the following places: To the drive gear teeth, around the shaft on each side of the gear, and around the tuner shaft at the hole in the alignment plate. See Detail 17C.

( ) Install the gear at AP. Then mount the gear mounting bracket over the gear and fasten it with #6 x 1/4" sheet metal screws at AR. Position the gear bracket so the gear is not tilted before tightening the screws.



Detail 17C



Detail 17D

Refer to Detail 17D for the following steps.

( ) Start an 8-32 x 1/4" setscrew in the anti-backlash gear.

( ) Start the gear on the tuner shaft. While holding the gear firmly with one hand, rotate the back half of the gear one notch with a screwdriver. See the inset drawing on Detail 17D. Hold the gear in this position, and then slide it onto the tuner shaft until the gears mesh. Position the gear flush with the end of the shaft and tighten the setscrew.

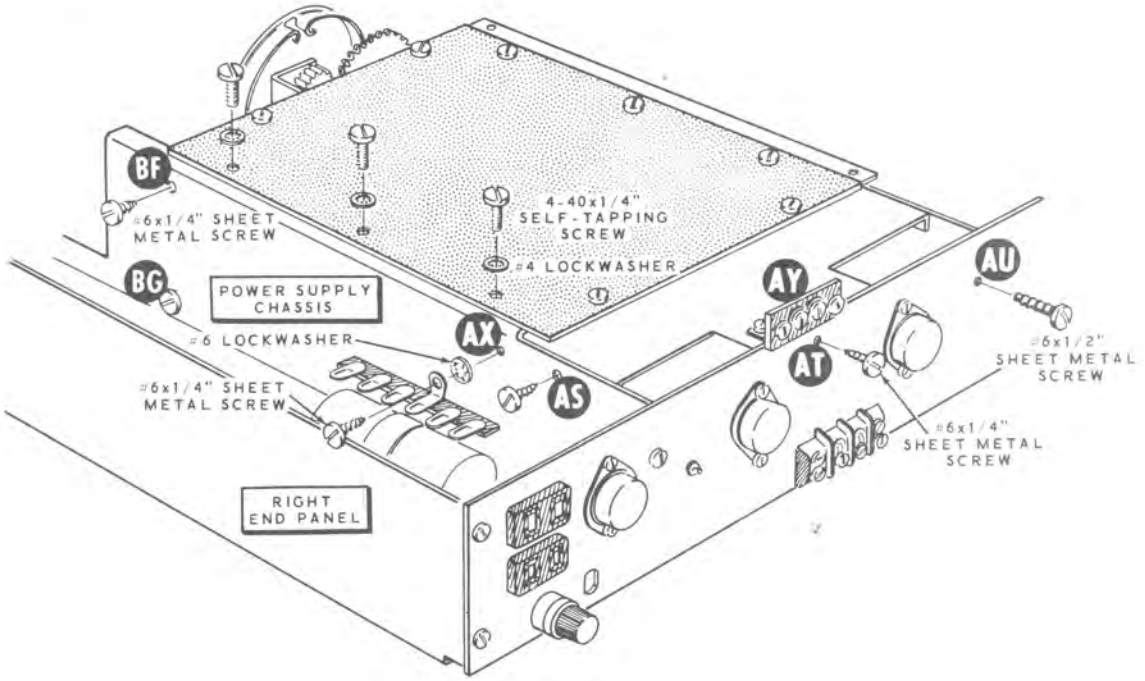
( ) Start an 8-32 x 3/16" setscrew in the dial pulley bushing.

( ) Rotate the drive gear shaft fully clockwise.

( ) Install the dial pulley on the drive gear shaft; the bushing should be pointed toward the shaft, and the opening in the pulley should be pointed down, as shown. The bushing should just clear the gear bracket. Tighten the setscrew.

Refer to Pictorial 18 for the following steps.

( ) Remove the four sheet metal screws that fasten the right end panel to the control panel and rear panel. Remove the panel and set it and the screws aside temporarily.



PICTORIAL 18

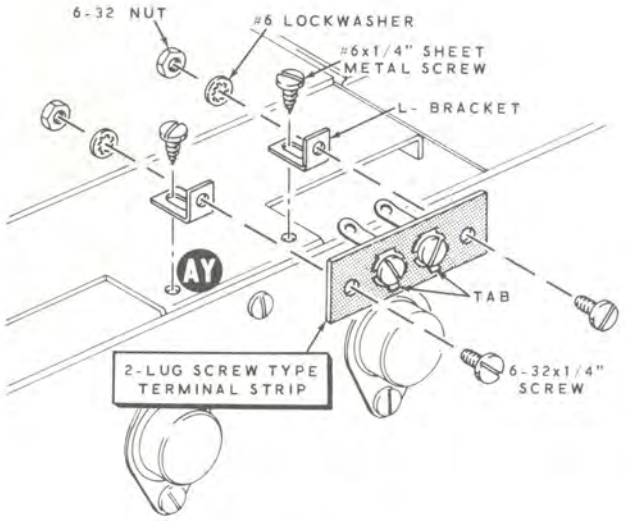
( ) Place the center panel assembly inside the main chassis assembly as shown.

( ) Fasten the circuit board to the power supply chassis with three 4-40 x 1/4" self-tapping screws and #4 lockwashers. Be careful not to overtighten these screws. This could strip the threads in the panels.

( ) Install #6 x 1/4" sheet metal screws at locations BF, BG, AS, and AT.

( ) Install a #6 x 1/2" sheet metal screw at location AU.

( ) Install a 6-lug terminal strip at location AX with a #6 x 1/4" sheet metal screw and a #6 lockwasher. Put the lockwasher under the terminal strip mounting foot.



Detail 18A

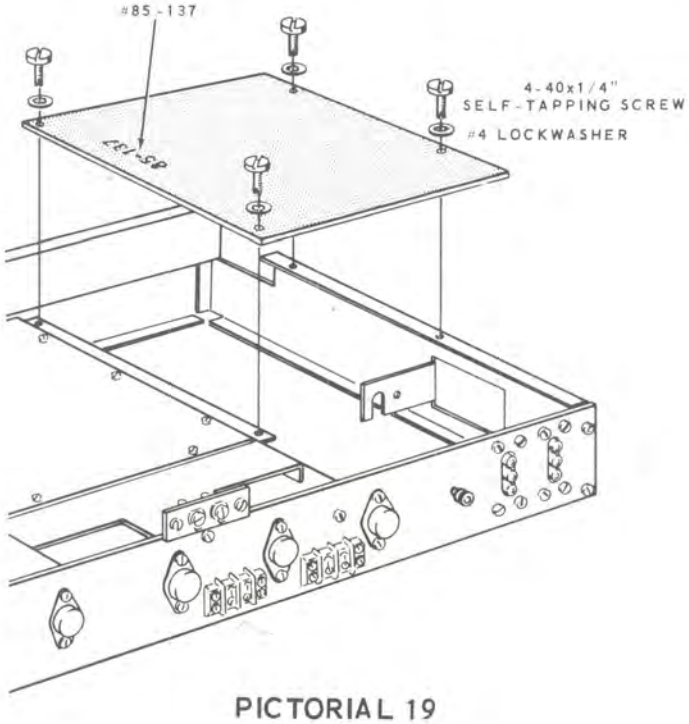
Refer to Detail 18A for the following steps.

( ) Position the 2-lug screw-type terminal strip with the tabs pointed down as shown. Then install the short end of two L-brackets to the terminal strip. Use 6-32 x 1/4" screws, #6 lockwashers, and 6-32 nuts. Do not tighten the screws yet.

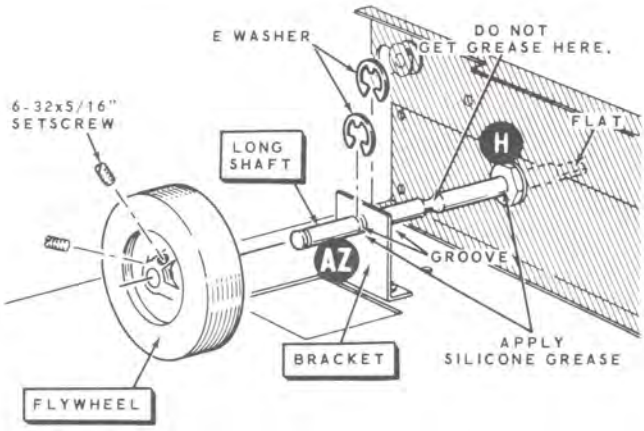
( ) Mount the terminal strip to the support plate at AY. Use #6 x 1/4" sheet metal screws. Now tighten the two screws on the terminal strip.

Refer to Pictorial 19 for the following step.

( ) Mount the remaining circuit board on the chassis so the number (85-137) on the foil side is positioned as shown. Use 4-40 x 1/4" self-tapping screws and #4 lockwashers. Be careful not to overtighten these screws; this could strip the threads in the panels.



PICTORIAL 19



Detail 20A

Refer to Detail 20A for the following steps.

( ) Locate the long shaft, flywheel, and two E washers.

( ) Install the end of the long shaft (the end with the flat side) through hole AZ and bushing H. Apply a small amount of silicone grease around the part of the shaft that rotates inside of bushing H and hole AZ.

( ) Position the long shaft so one of the closely spaced grooves is on each side of the bracket. Then install an E washer in each groove.

( ) Start two 6-32 x 5/16" setscrews in the small holes in the flywheel.

( ) Install the flywheel onto the shaft with the side that has the setscrews as shown. Position the flywheel flush with the end of the shaft and tighten both setscrews.

( ) If the shaft does not turn easily inside bushing H, loosen the bushing nut slightly. Then move the bushing slightly while turning the shaft, until a spot is found where the shaft turns easily. Then tighten the nut again.

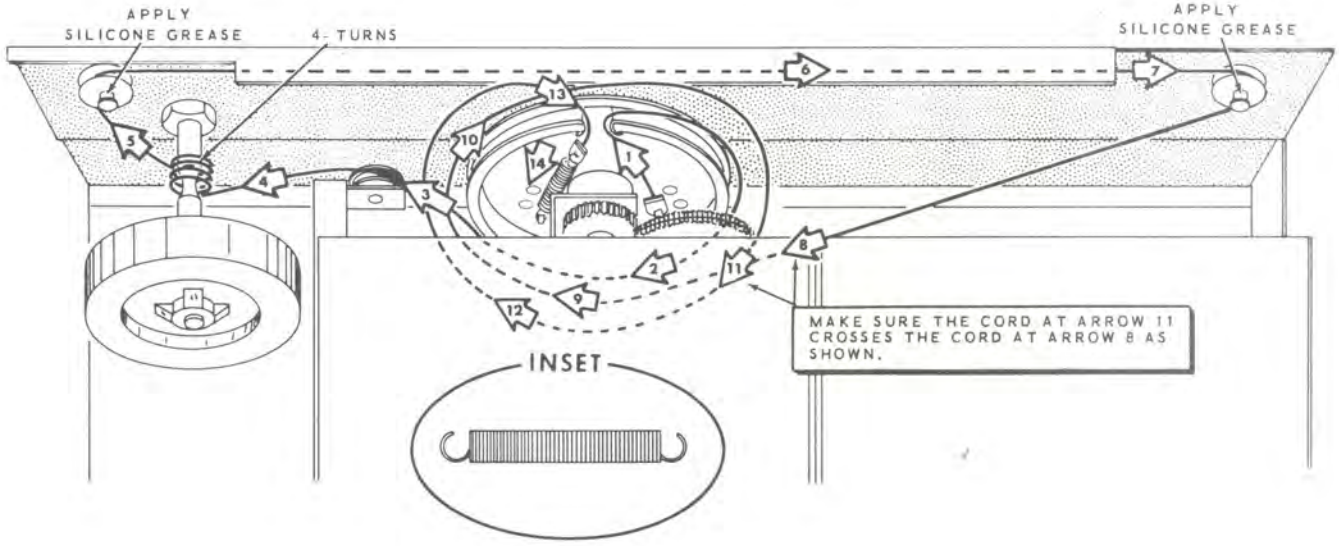
DIAL STRINGING

Refer to Pictorial 20 for the following steps.

( ) Use a screwdriver to apply a small amount of silicone grease to the shafts of both pulleys on the control panel. Be careful not to get silicone grease in the pulley groove. Rotate the pulleys to work the grease around the shafts.

( ) Locate the dial cord assembly and dial cord spring.

( ) Refer to the inset drawing on Pictorial 20. Bend out each end of the spring to form a small hook, then set the spring aside temporarily.



PICTORIAL 20

( ) Rotate the dial drum fully counterclockwise as viewed from the front of the control panel.

( ) Follow the numbered arrows on Pictorial 20, starting with number 1, and complete the dial stringing. You may rotate the dial pulley in order to reach the hook more easily. At arrow number 14 connect the dial spring between the end of the dial cord and the small hook in the pulley.

( ) Temporarily install a knob for a 1/2" shaft on the tuning shaft.

The purpose of the next three steps is to make sure the dial pulley turns without binding.

( ) A. Be sure the opening in the dial pulley is in the position shown in the Pictorial. Then rotate the knob until the opening in the pulley turns 360 degrees.

( ) B. Now turn the knob until the opening in the pulley is back in its original position. If the dial pulley turned smoothly without binding, proceed to the Chassis Wiring.

( ) If the dial pulley binds at some point, it is possible that the cord at arrow 11 is on the wrong side of the cord at arrow 8. Carefully unstring the cord at arrows 14, 13, 12, and 11. Be sure to read the note at arrows 8 and 11, and then restring the dial cord at 11, 12, 13, and 14. Then repeat steps A and B to make sure the pulley turns smoothly without binding.

( ) Remove the knob from the tuning shaft.

CHASSIS WIRING

Refer to Pictorial 21 (fold-out from Page 24) for the following steps.

( ) Remove the solder holding the cables to the end panel.

Connect the wires coming from the following cables to the numbered holes on the amplifier circuit board. Solder each wire to the foil side of the board.

8-WIRE CABLE #1 (coming from controls C and D)

( ) Black wire to 22.

( ) Yellow wire to 36.

( ) White wire to 38.

( ) Brown wire to 30.

( ) Blue wire to 26.

( ) Red wire to 32.

( ) Orange wire to 34.

8-WIRE CABLE #2 (coming from controls C and D)

( ) Black wire to 21.

( ) White wire to 37.

( ) Yellow wire to 35.

( ) Red wire to 31.

( ) Brown wire to 29.

( ) Blue wire to 25.

( ) Orange wire to 33.

( ) Connect the lead of coaxial cable #3 coming from control F to hole 24.

( ) Connect the lead of coaxial cable #4 coming from control F to hole 23.

( ) Prepare the following lengths of hookup wire:

2-1/2" white	2-1/2" red
2-3/4" white	2-3/4" red
2-3/4" white	4-1/2" red
4-1/2" white	

Connect the following wires from phono sockets N and P to the numbered holes on the amplifier circuit board.

( ) 2-1/2" white wire from lug 1 of N (S-1) to hole 1 (S-1).

( ) 2-3/4" white wire from lug 2 of N (S-2) to hole E (S-1).

( ) 2-3/4" white wire from lug 3 of N (S-1) to hole 3 (S-1).

( ) 4-1/2" white wire from lug 4 of N (S-1) to hole 27 (S-1).

( ) 2-1/2" red wire from lug 1 of P (S-1) to hole 2 (S-1).

( ) 2-3/4" red wire from lug 3 of P (S-1) to hole 4 (S-1).

( ) 4-1/2" red wire from lug 4 of P (S-1) to hole 28 (S-1).

( ) Prepare the following lengths of hookup wire:

7-1/2" red	14" black
7-1/2" white	14-1/2" violet
6-1/2" green	8" red
6-1/2" yellow	12" red

Connect the following wires from transistor sockets S, X, and Z to the numbered holes in the amplifier circuit board.

NOTE: After connecting the wires in the following six steps, position them against the center panel and the amplifier circuit board as shown in Detail 21A.

( ) Connect a 7-1/2" red wire from lug 2 of S (S-1) to hole 41 (S-1).

( ) Connect a 7-1/2" white wire from lug 1 of S (S-1) to hole 39 (S-1).

( ) Connect a 6-1/2" green wire from lug 1 of X (S-2) to hole 43 (S-1).

( ) Connect a 6-1/2" yellow wire from lug 2 of X (S-1) to hole 45 (S-1).

( ) Connect a 14" black wire from lug 1 of Z (S-1) to hole 42 (S-1).

( ) Connect a 14-1/2" violet wire from lug 2 of Z (NS) to hole 40 (S-1).

( ) Connect an 8" red wire to lug 2 of terminal strip AL (NS). Route the other end of the wire through hole BB to be connected later.

( ) Connect a 12" red wire to lug 1 of terminal strip AL (NS). Route the other end of the wire near phono socket P as shown. It will be connected later.

( ) Prepare the following lengths of hookup wire:

6" yellow	11" black stranded
6" yellow	12" brown
2-1/2" black stranded	14-1/2" gray
4-1/2" black stranded	

( ) Connect a 6" yellow wire from lug 4 of terminal strip AL (NS) to lug 3 of transistor socket X (NS).

( ) Connect a 6" yellow wire to lug 4 of terminal strip AL (NS). Route the other end of the wire through hole BB to be connected later.

( ) Connect a 2-1/2" black stranded wire from lug 3 of terminal strip AL (NS) to lug 3 of transistor socket Z (S-3).

( ) Connect a 4-1/2" black stranded wire to lug 3 of terminal strip AL (NS). Route the other end of the wire through hole BB to be connected later.

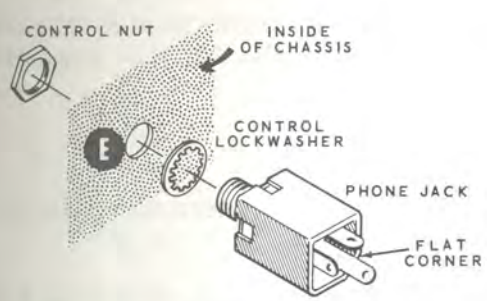
( ) Connect an 11" black stranded wire to lug 3 of terminal strip AL (S-3). Route the other end of the wire near phono socket P as shown. It will be connected later.

( ) Connect a 12" brown wire from lug 1 of terminal strip T (S-1) to lug 8 of control D (S-1). Position the wire as shown in Detail 21A.

( ) Connect a 14-1/2" gray wire from lug 1 of terminal strip Y (S-1) to lug 10 of control D (S-1). Position the wire as shown in Detail 21A.

( ) Insert the 4-wire cable through hole BA. Connect the wires of this cable to the numbered holes in the FM-multiplex circuit board as directed in the next four steps. Solder each wire to the foil side of the circuit board.

( ) Green wire to 8.
( ) White wire to 9.
( ) Black wire to 10.
( ) Red wire to 11.



Detail 22A

Refer to Pictorial 22 (fold-out from Page 33) for the following steps.

( ) Mount the phone jack at location E with a control lockwasher and nut. See Detail 22A. Be sure to position the flat corner as shown in Pictorial 22.

( ) Prepare the following lengths of hookup wire:

9" black	7" yellow
15" green	3-1/2" green
14" white	

NOTE: After connecting the wires in the following five steps, position them against the center panel and amplifier circuit board.

( ) Connect a 9" black wire from hole A in the amplifier circuit board (S-1) to lug 3 of transistor socket X (S-2).

( ) Connect a 15" green wire in hole 46 of the amplifier circuit board (S-1). Route the other end of this wire through hole BB to be connected later.

( ) Connect a 14" white wire in hole 44 of the amplifier circuit board (S-1). Route the other end of this wire through hole BB to be connected later.

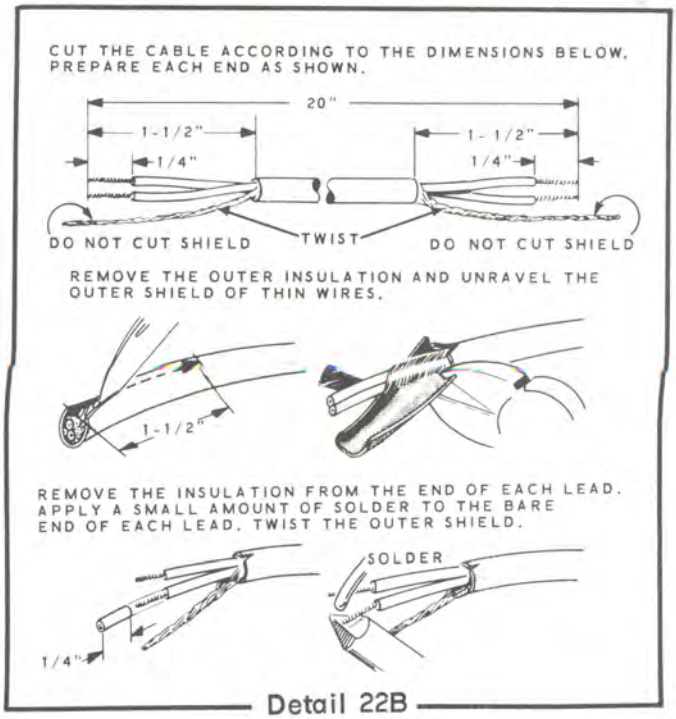
( ) Connect a 7" yellow wire from hole 47 of the amplifier circuit board (S-1) to lug 7 of control D (NS).

( ) Connect a 3-1/2" green wire from hole 48 of the amplifier circuit board (S-1) to lug 9 of control D (NS).

( ) Connect a 100 Ω (brown-black-brown) 1/2 watt resistor from lug 2 of phone jack E (S-1) to lug 7 of control D (S-2).

( ) Install a 3/4" length of sleeving on one lead of a 100 Ω (brown-black-brown) 1/2 watt resistor. Connect this lead to lug 9 of control D (S-2), and connect the remaining lead to lug 1 of phone jack E (S-1). NOTE: No connections will be made to the remaining lug of the phone jack.

( ) Prepare a 20" length of 2-wire shielded cable as shown in Detail 22B.



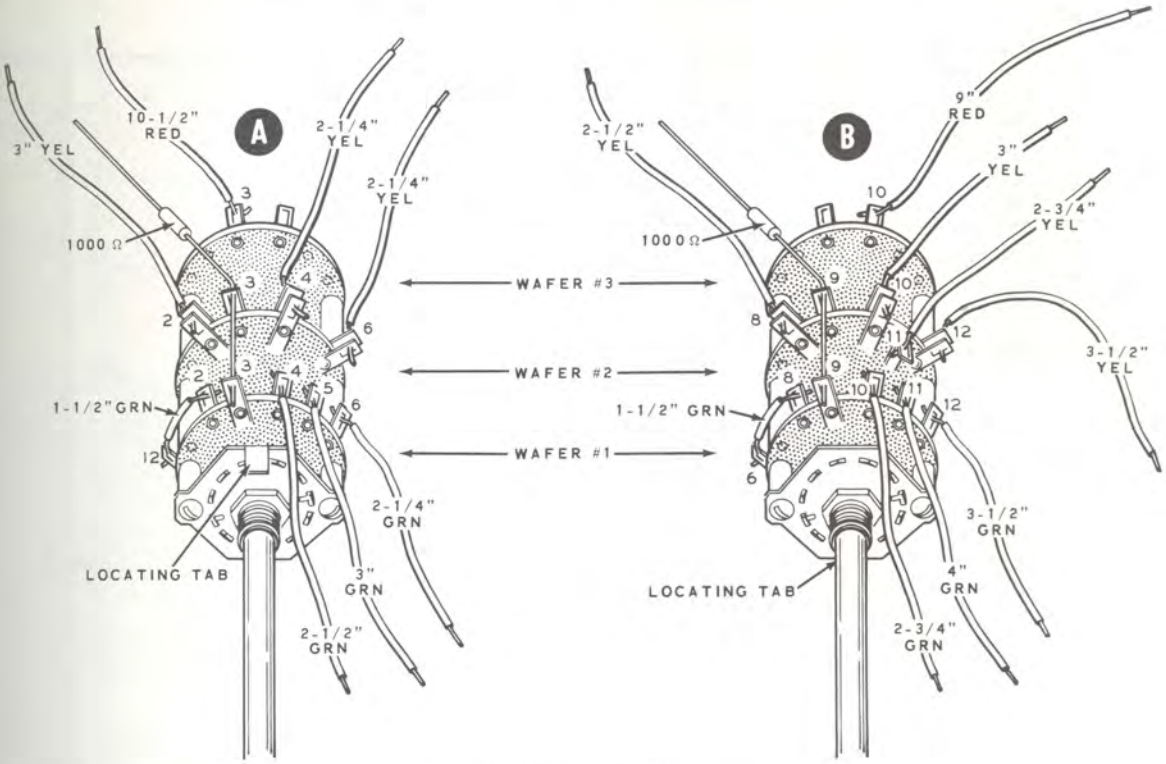
Detail 22B

( ) At one end of the cable connect the green wire to lug 7 (S-1) and the yellow wire to lug 8 (S-1) of control C.

( ) Install a 2-1/2" length of sleeving over the shield lead. Connect this lead to the control solder lug at C (S-1).

( ) Route the other end of the cable through hole BB, to be connected later.

( ) Slip cable clamps over the cable at locations BC and BD. Fasten the clamps to the center panel with #6 x 3/8" sheet metal screws as shown in the inset drawing on Pictorial 22.



PICTORIAL 23

Position the switch with the locating tab as shown in part B of Pictorial 23; then complete the following steps.

WAFER #1

( ) Connect a 1-1/2" green wire between lugs 8 (S-1) and 6 (S-2).

( ) Connect a 2-3/4" green wire to lug 10 (S-1).

( ) Connect a 4" green wire to lug 11 (S-1).

( ) Connect a 3-1/2" green wire to lug 12 (S-2).

WAFER #2

( ) Connect a 2-1/2" yellow wire to lugs 8 (S-2).

( ) Connect a 1000 Ω (brown-black-red) 1/4 watt resistor through lug 9 of wafer 2 (S-2) to lug 9 of wafer 1 (S-1).

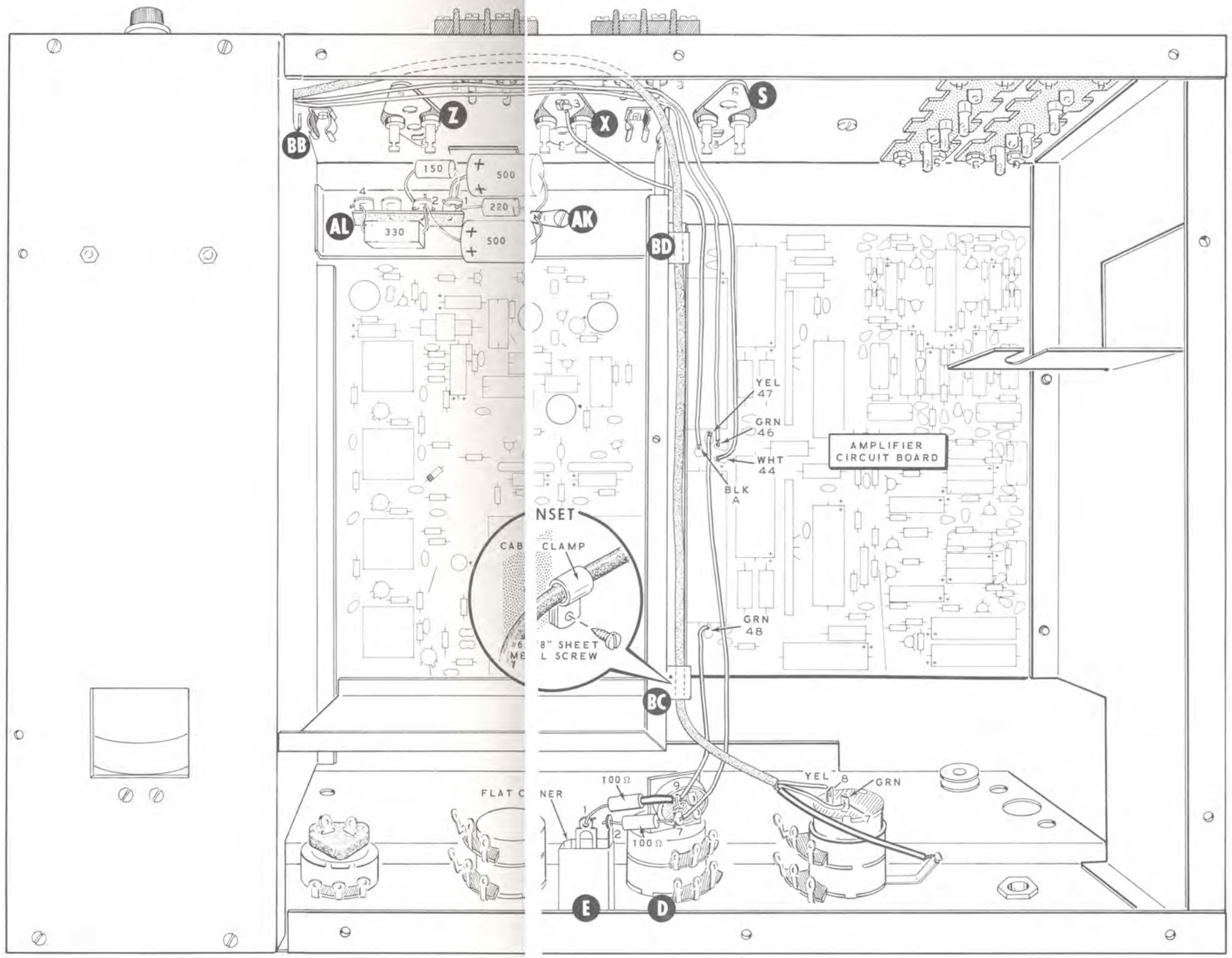
( ) Connect a 3" yellow wire to lugs 10 (S-2).

( ) Connect a 2-3/4" yellow wire to lug 11 (S-1).

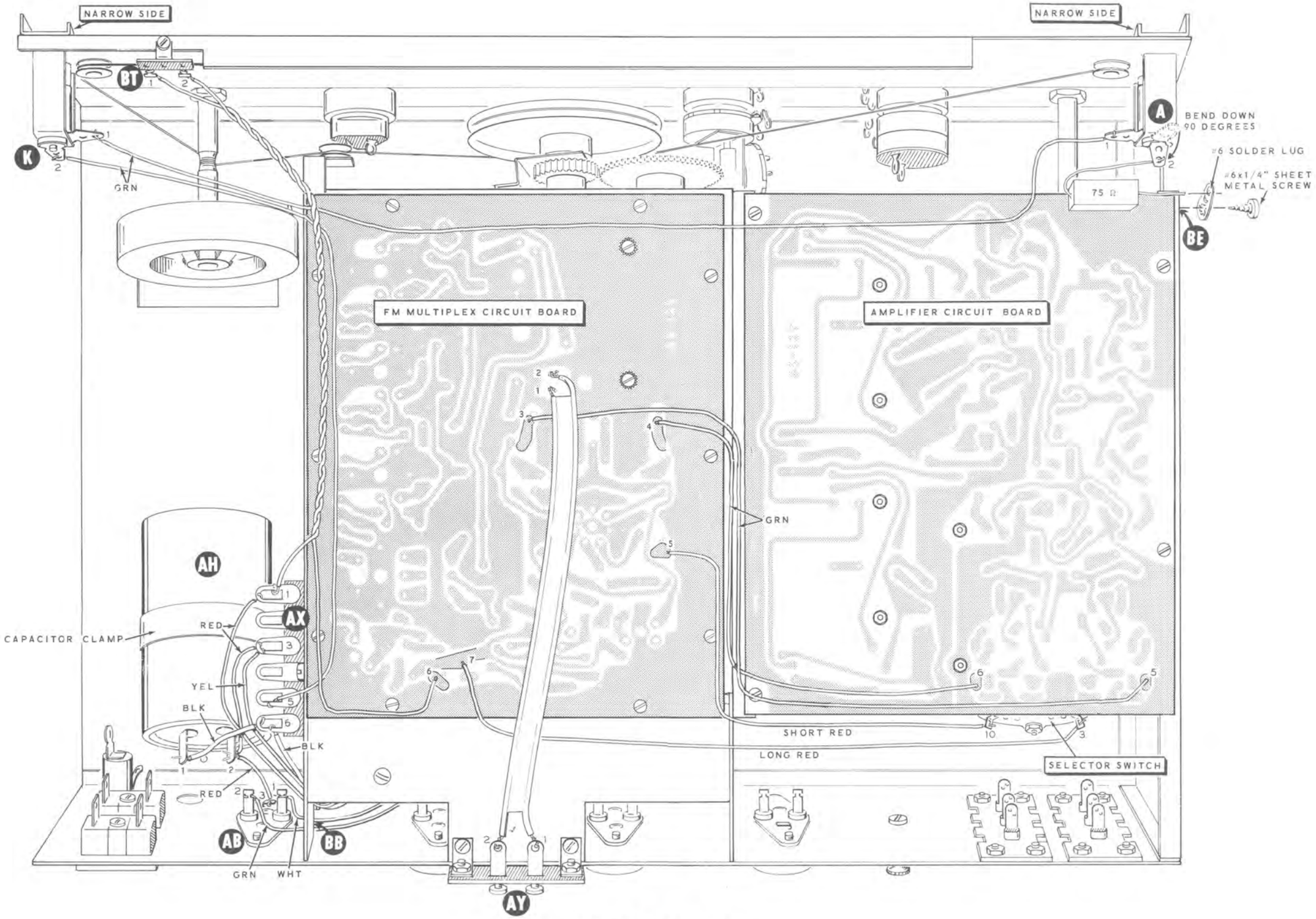
( ) Connect a 3-1/2" yellow wire to lugs 12 (S-2).

WAFER #3

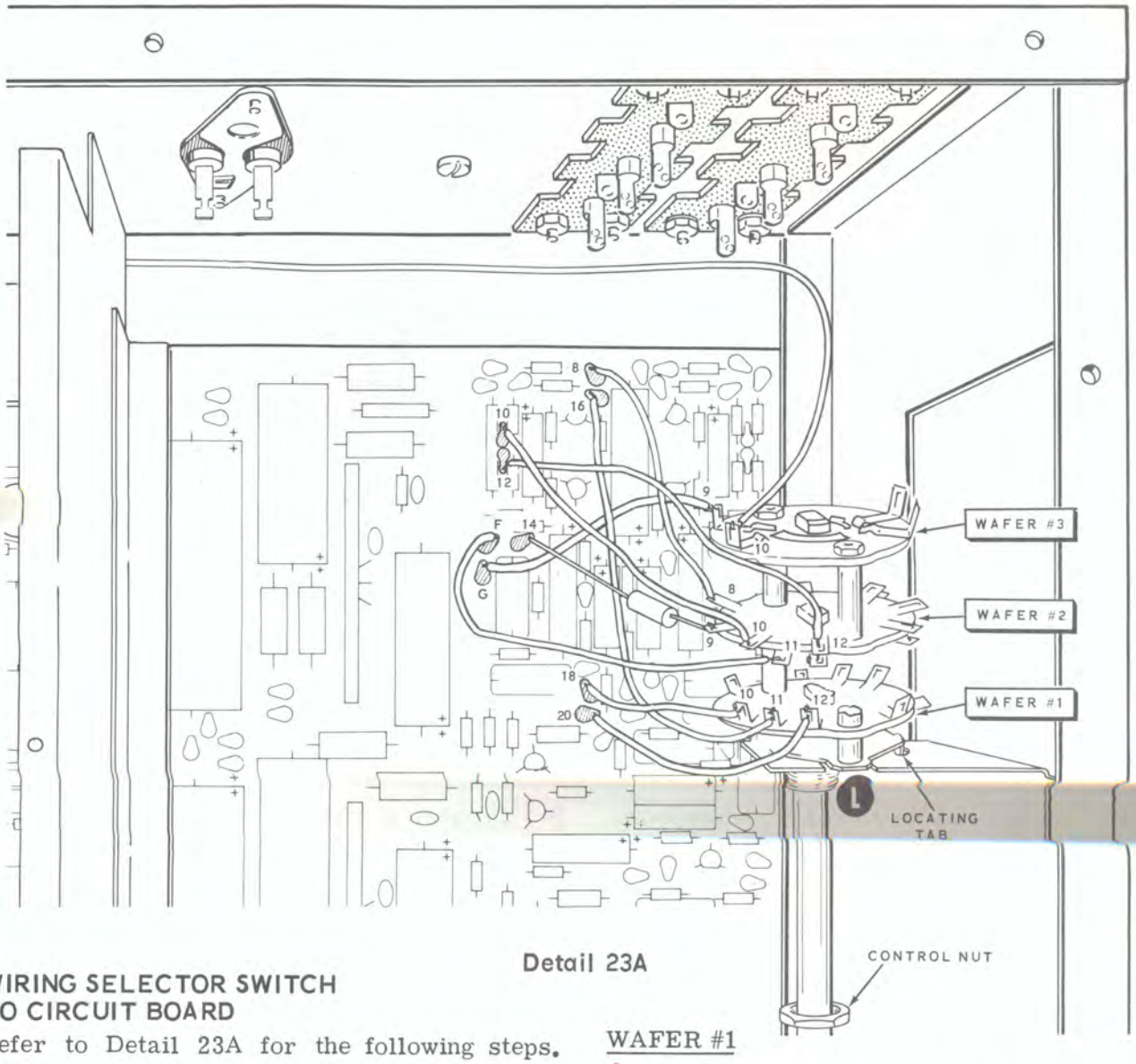
( ) Connect a 9" red wire to lug 10 (S-1).


Z
X
S
BB
150
500
220
330
500
4
2
AL
AK
BD
YEL
47
GRN
46
WHT
44
BLK
A
AMPLIFIER
CIRCUIT BOARD
NSET
CLAMP
GRN
48
8" SHEET
L SCREW
BC
100 Ω
100 Ω
YEL
8
GRN
E
D

PI ORIAL 22



PICTORIAL 25



Detail 23A

WIRING SELECTOR SWITCH TO CIRCUIT BOARD

Refer to Detail 23A for the following steps.

NOTE: Be careful not to push on the switch wafers when installing the selector switch in the following step.

( ) Slide a control nut onto the shaft of the selector switch. Turn the switch so that the locating tab lines up with the small hole in the end panel bracket at L. Then install the switch by inserting the end of the shaft into the front panel bushing and the switch bushing into slot L. Now tighten the control nut.

Connect the wires and resistors coming from the selector switch to the numbered holes in the amplifier circuit board in the following steps. Solder the wires to the foil side of the board.

WAFER #1

( ) Green wire from lug 10 to hole 18.

( ) Green wire from lug 11 to hole 16.

( ) Green wire from lug 12 to hole 20.

WAFER #2

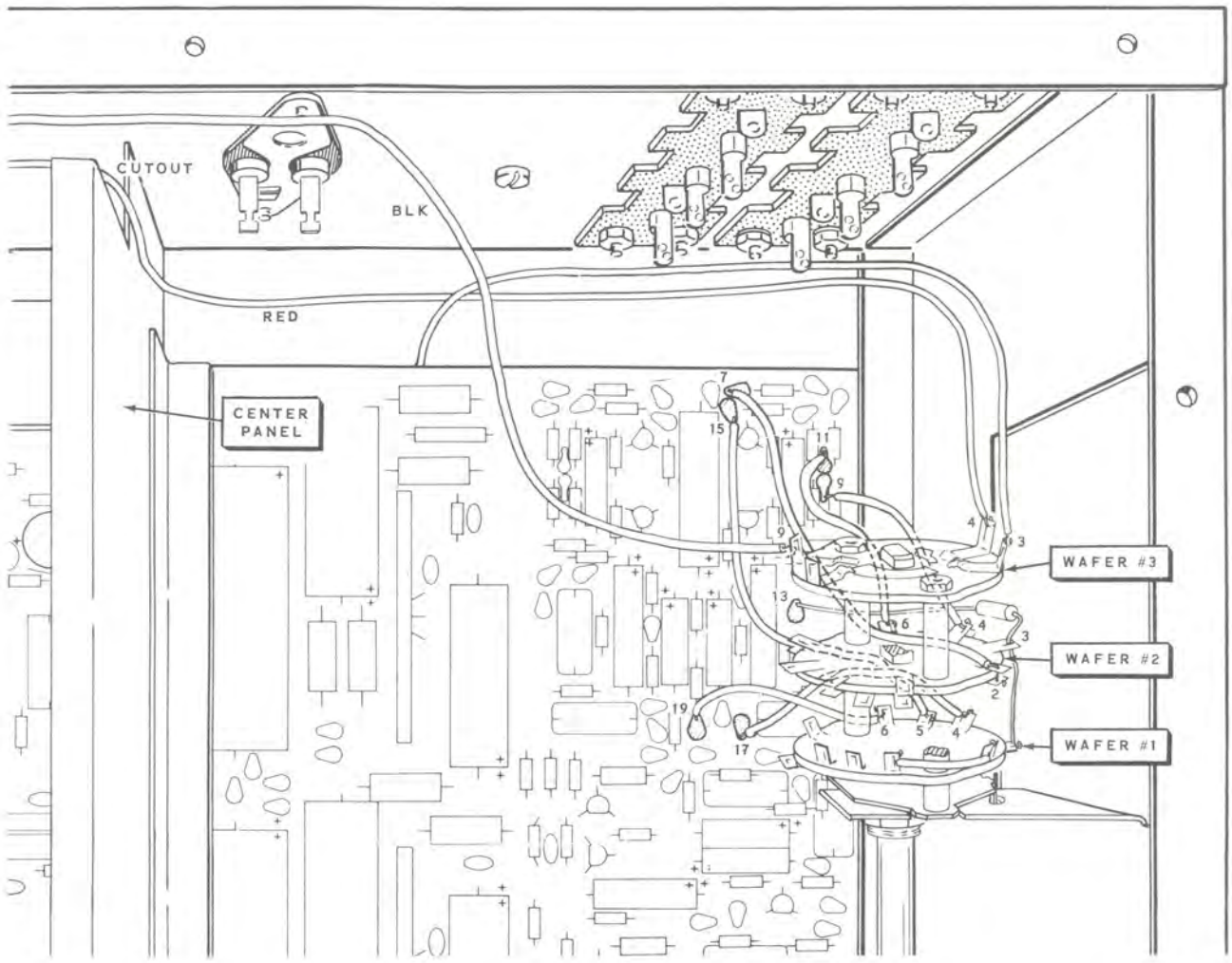
( ) Yellow wire from lug 8 to hole 8.

( ) Resistor from lug 9 to hole 14.

( ) Yellow wire from lug 10 to hole 10.

( ) Yellow wire from lug 11 to hole F.

( ) Yellow wire from lug 12 to hole 12.



Detail 23B

WAFER #3

( ) Connect a 2-1/2" black stranded wire from lug 9 (NS) to hole G.

The red wire from lug 10 will be connected to the foil side of the FM-Multiplex circuit board in a later step.

Refer to Detail 23B for the following steps.

WAFER #1

( ) Green wire from lug 4 to hole 17.

( ) Green wire from lug 5 to hole 15.

( ) Green wire from lug 6 to hole 19.

WAFER #2

( ) Yellow wire from lug 2 to hole 7.

( ) Resistor from lug 3 to hole 13.

( ) Yellow wire from lug 4 to hole 9.

( ) Yellow wire from lug 6 to hole 11.

WAFER #3

The red wire from lug 3 will be connected to the FM-Multiplex circuit board in a later step.

( ) Connect the end of the red wire coming through the cutout in the center panel, to lug 4 of wafer #3 (S-1).

( ) Connect the end of the black wire coming through the cutout in the center panel, to lug 9 of wafer #3 (S-2).

INSTALLING TRANSISTORS

Refer to Detail 24A for the following steps.

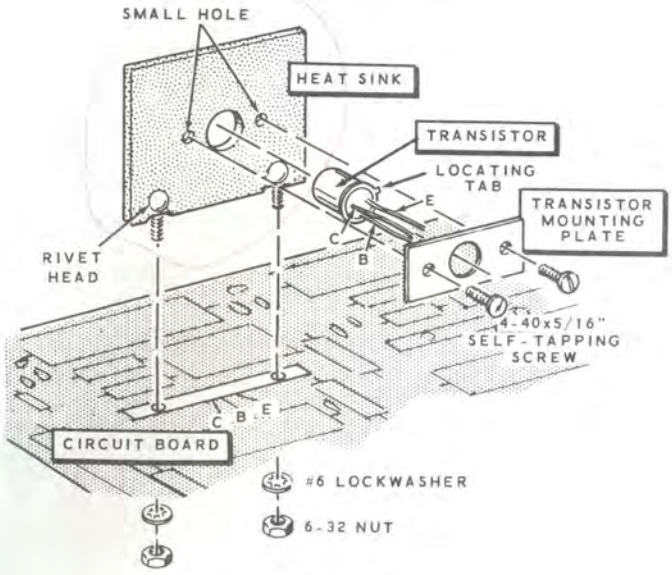
( ) Locate both transistors #417-100 (2N3053), both transistor mounting plates, and both heat sinks. Position the heat sink with the rivet side as shown, and then mount the parts on both heat sinks as described in the following steps.

( ) Note that the leads of each transistor are grouped near one side of the transistor. The emitter (E) lead is the one closest to the locating tab. The next lead, the one nearest to the emitter lead, is the base (B) lead. The remaining lead is the collector (C) lead. Install the transistor in the heat sink with the emitter and collector leads opposite the indicated small holes.

( ) Install a transistor mounting plate on the heat sink with 4-40 x 5/16" self-tapping screws. Position the transistor leads through the large hole in the plate.

( ) Install heat sinks on the circuit board at Q11 and Q12. See Pictorial 24. Insert the transistor leads through their respective holes C, B, and E, and insert the spade bolts through the mounting holes. Use #6 lockwashers and 6-32 nuts on the spade bolts.

( ) Solder the transistor leads to the foil side of the circuit board. Make sure the leads do not touch each other or the transistor mounting plate.

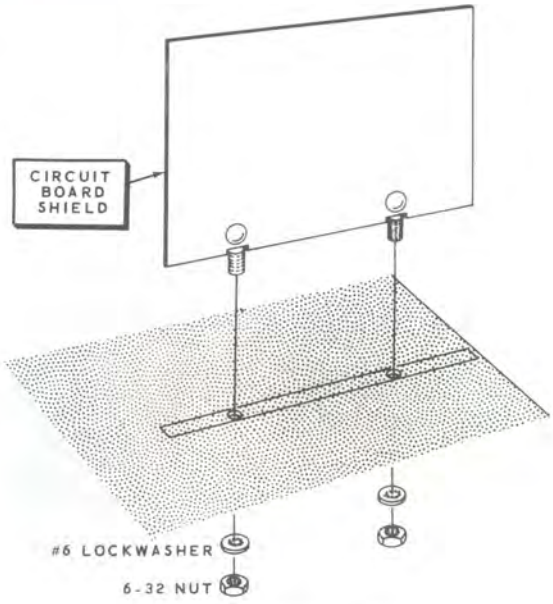


Detail 24A

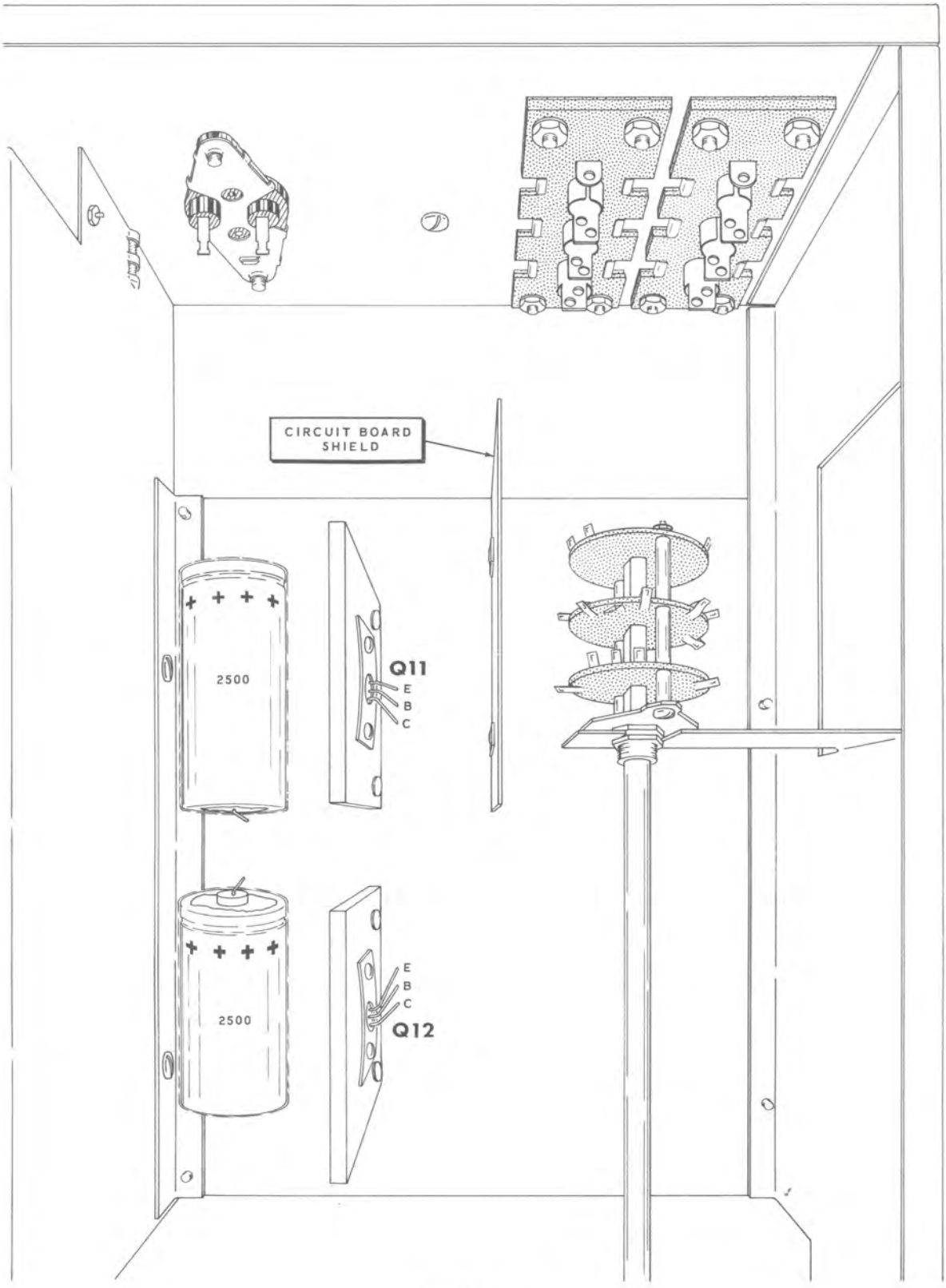
Refer to Detail 24B for the following steps.

( ) Install the shield on the circuit board at the location shown in Pictorial 24. Use #6 lockwashers and 6-32 nuts.

( ) Refer to Pictorial 24 and install two 2500 µfd electrolytic capacitors on the circuit board with the positive (+) leads positioned as shown. Solder the leads to the foil side of the board.



Detail 24B



PICTORIAL 24

FINAL WIRING

Refer to Pictorial 25 (fold-out from Page 34) for the following steps.

(✓) Loosen the two nuts that fasten the capacitor clamp to the chassis. Then push capacitor AH back away from the rear panel so lugs 1 and 2 can be easily reached.

(✓) Connect the white wire coming through cutout BB to lug 1 of transistor socket AB (S-2).

(✓) Connect a 2" red wire from lug 3 of transistor socket AB (S-1) to lug 2 of capacitor AH (NS).

(✓) Connect a 4" red wire from lug 2 of capacitor AH (S-2) to lug 3 of terminal strip AX (NS).

(✓) Connect the green wire coming through cutout BB to lug 2 of transistor socket AB (S-1).

(✓) Connect the red wire coming through cutout BB to lug 1 of terminal strip AX (NS).

(✓) Connect the yellow wire coming through cutout BB to lug 3 of terminal strip AX (NS).

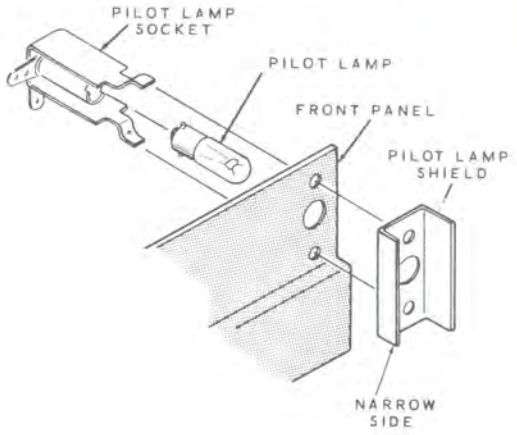
(✓) Connect the black wire coming through cutout BB to lug 6 of terminal strip AX (NS).

( ) Connect a 2-3/4" black <u>stranded</u> wire from lug 1 of capacitor AH (S-1) to lug 6 of terminal strip AX (NS).

( ) Push capacitor AH toward the rear panel until the front of the case is approximately 1" away from it. Also, make sure the capacitor does not cover the small hole in the chassis near the front of the case. Then tighten the nuts on the capacitor clamp.

Refer to Detail 25A for the following steps.

( ) Locate both pilot lamps, pilot lamp sockets, and pilot lamp shields. Install a lamp in each socket.



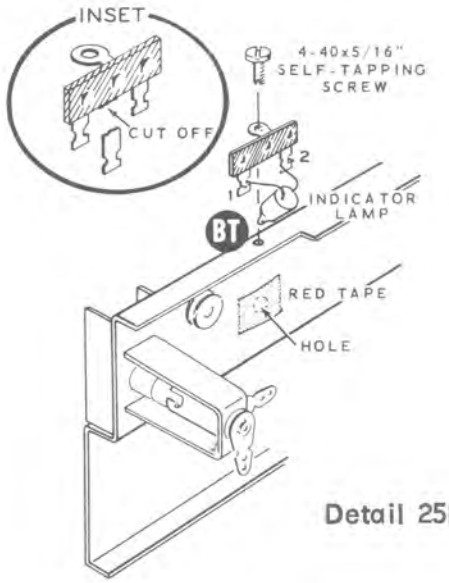
Detail 25A

NOTE: When mounting the sockets and shields in the following steps, be sure lugs 1 and 2 of the sockets, and the narrow side of the shield, are pointed as shown in the Pictorial.

( ) Mount a lamp shield and socket at A and K.

Refer to Detail 25B for the following steps.

( ) Cut off the center lug of the 3-lug miniature terminal strip. See the inset drawing on Detail 25B. Mount the terminal strip on the control panel at BT. Use a 4-40 x 5/16" self-tapping screw. After mounting it, bend the terminal strip away from the dial cord slightly.



Detail 25B

( ) Carefully connect the indicator lamp between lugs 1 (NS) and 2 (NS) of terminal strip BT. Bend the leads so the end of the lamp is near the small hole under the red tape.

NOTE: After connecting the following wires route them as shown in the Pictorial.

( ) Connect a 12" green wire to lug 1 (S-2) and a 9" green wire to lug 2 (S-2) of terminal strip BT. Then twist the two wires together as shown in the Pictorial.

( ) At the other end of this twisted pair, connect the short wire to lug 1 of terminal strip AX (S-2). Connect the other wire to hole 6 of the FM-multiplex circuit board (S-1).

( ) Connect a 12" green wire from lug 2 of lamp socket K (S-1) to lug 5 of terminal strip AX (NS).

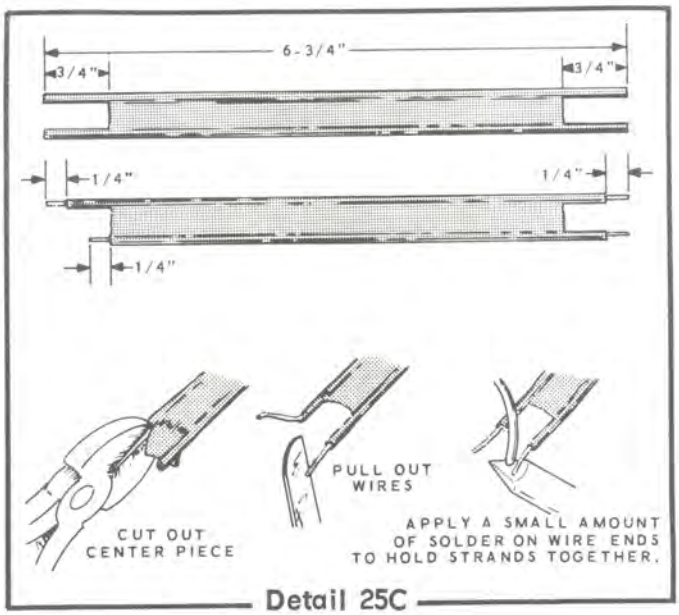
( ) Connect a 15" green wire from lug 1 of lamp socket K (S-1) to lug 1 of lamp socket A (S-1).

( ) Connect the free end of the red wire coming from lug 10 of the selector switch (wafer #3) to hole 5 of the FM-multiplex circuit board (S-1). Position the wire as shown.

( ) Connect the free end of the red wire coming from lug 3 of the selector switch to hole 7 of the FM-multiplex circuit board (S-1).

( ) Connect a 9" green wire from hole 4 of the FM-multiplex circuit board (S-1) to hole 6 (this hole is not numbered) of the amplifier circuit board (S-1). Position the wire as shown.

( ) Connect a 12" green wire from hole 3 of the FM-multiplex circuit board (S-1) to hole 5 (this hole is not numbered) of the amplifier circuit board (S-1). Position the wire as shown.



Detail 25C

( ) Refer to Detail 25C and prepare a 6-3/4" length of twin lead.

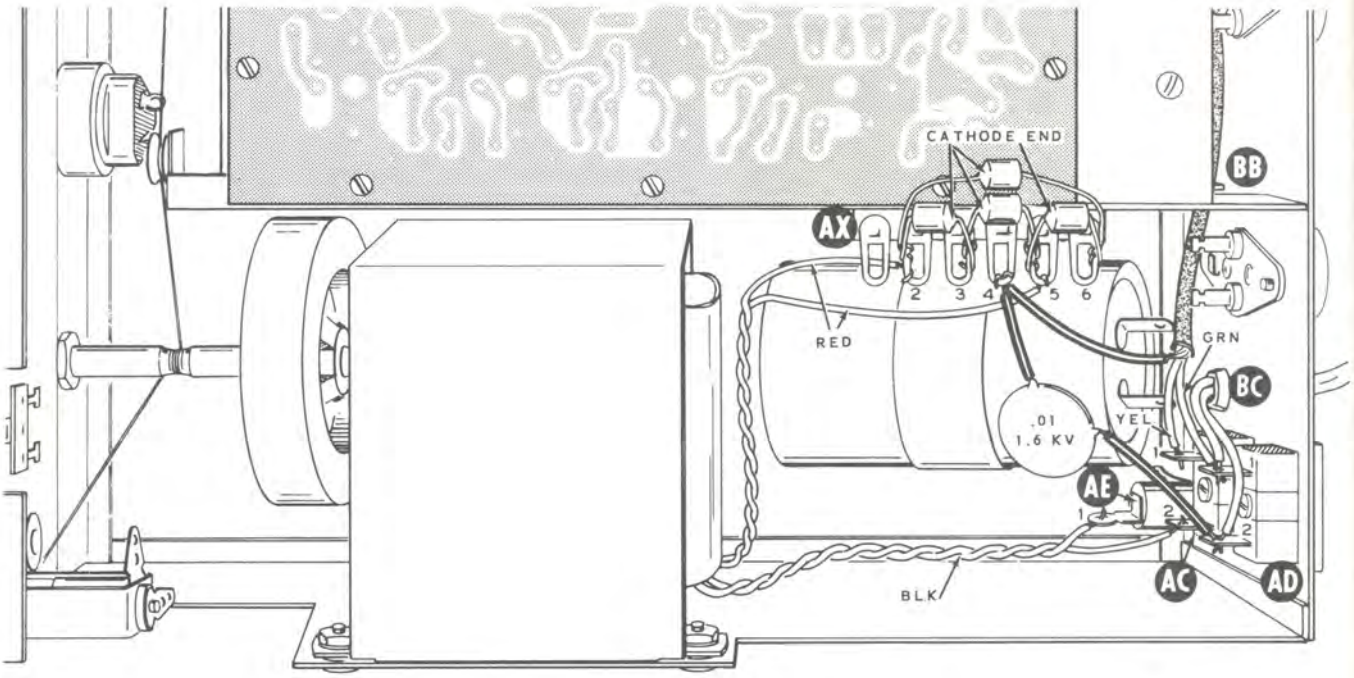
( ) At the end of the twin lead with the short wire, form a small hook at the end of each wire.

( ) Connect the short wire to lug 1 (NS) and the long wire to lug 2 (NS) on the FM-multiplex circuit board. Route the other end of the twin lead to terminal strip AY. Now solder lugs 1 and 2 of the circuit board.

( ) At the other end of the twin lead connect one wire to lug 1 (S-1) and the other wire to lug 2 (S-1) of terminal strip AY.

( ) Straighten a #6 solder lug and then mount it to the end panel at BE with a #6 x 1/4" sheet metal screw.

( ) Bend lug 2 of lamp socket A at a 90 degree angle as shown. Connect a 75 Ω 5 watt resistor from lug 2 of A (S-1) to solder lug BE (S-1).



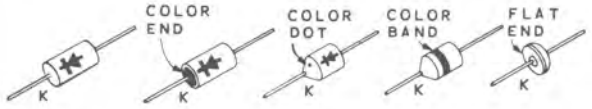
PICTORIAL 26

Refer to Pictorial 26 for the following steps.

NOTE: When you install the following diodes, leave the leads long enough so the diodes can be positioned away from the terminal strip, as shown.

( ) Connect a silicon diode between lugs 2 (NS) and 3 (NS) of terminal strip AX. Note the cathode end of the diode. See Detail 26A.

NOTE: WHEN INSTALLING SILICON DIODES, THE CATHODE END MUST BE PLACED AS DIRECTED. THE CATHODE END IS MARKED WITH EITHER A COLOR END, COLOR DOT, COLOR BAND, OR BY THE FLAT END OF THE DIODE. IN THE ILLUSTRATION, THE SYMBOL K INDICATES THE CATHODE END.



Detail 26A

( ) Connect a silicon diode between lugs 3 (S-4) and 5 (NS) of terminal strip AX. Note the cathode end.

( ) Connect a silicon diode between lugs 5 (NS) and 6 (NS) of terminal strip AX. Note the cathode end.

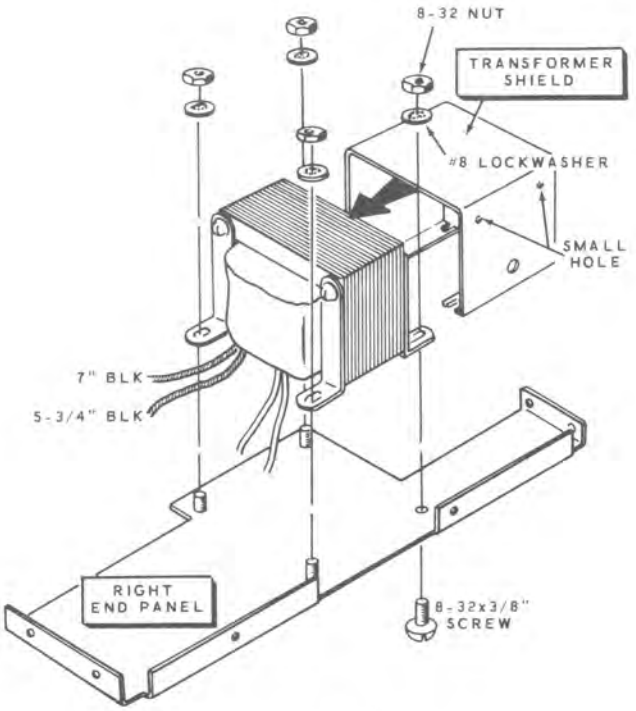
( ) Connect a silicon diode between lugs 2 (NS) and 6 (S-4) of terminal strip AX. Note the cathode end.

Connect the cable wires that come through cutout BB in the following steps.

( ) Yellow wire to lug 1 of socket AC (S-2).

( ) Green wire to lug 1 of socket AD (NS).

( ) Install a 2-1/2" length of sleeving on the shield wire. Connect this wire to lug 4 of terminal strip AX (NS).



Detail 26B

( ) Install a 1" length of sleeving on each lead of the .01 μfd 1.6 KV capacitor. Connect the capacitor from lug 2 of socket AD (NS) to lug 4 of terminal strip AX (S-2).

Refer to Detail 26B for the following steps.

( ) Install four 8-32 x 3/8" screws in the right end panel. Place the panel on your work surface so the screws won't fall out.

( ) Position the transformer with the leads as shown and the transformer shield with the small holes on the side as shown. Then slide the shield over the transformer.

( ) Install the transformer on the screws in the end panel. Use #8 lockwashers and 8-32 nuts. Tighten the nuts finger tight only.

( ) Measure the black transformer leads from where they come out of the transformer. Cut them to the dimensions shown and remove 1/4" of insulation from the end of each lead.

( ) Refer to Pictorial 26 and install the end panel to the chassis. Fasten the end panel to the control and rear panels with four #6 x 1/4" sheet metal screws. Do not tighten the screws at this time.

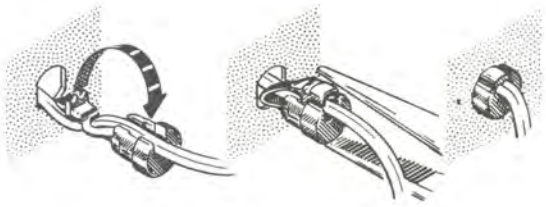
( ) Slide the transformer away from the flywheel (approximately 1/16"); and then tighten the four transformer mounting screws.

( ) Twist together the black transformer leads. Connect the short lead to lug 1 of fuseholder AE (S-1). Connect the other lead to lug 2 of socket AC (S-2).

( ) Twist together the red transformer leads. Connect one lead to lug 2 (S-3) and the other to lug 5 (S-4) of terminal strip AX.

( ) Locate the line cord and apply a small amount of solder to the end of each lead to hold the small wire strands together.

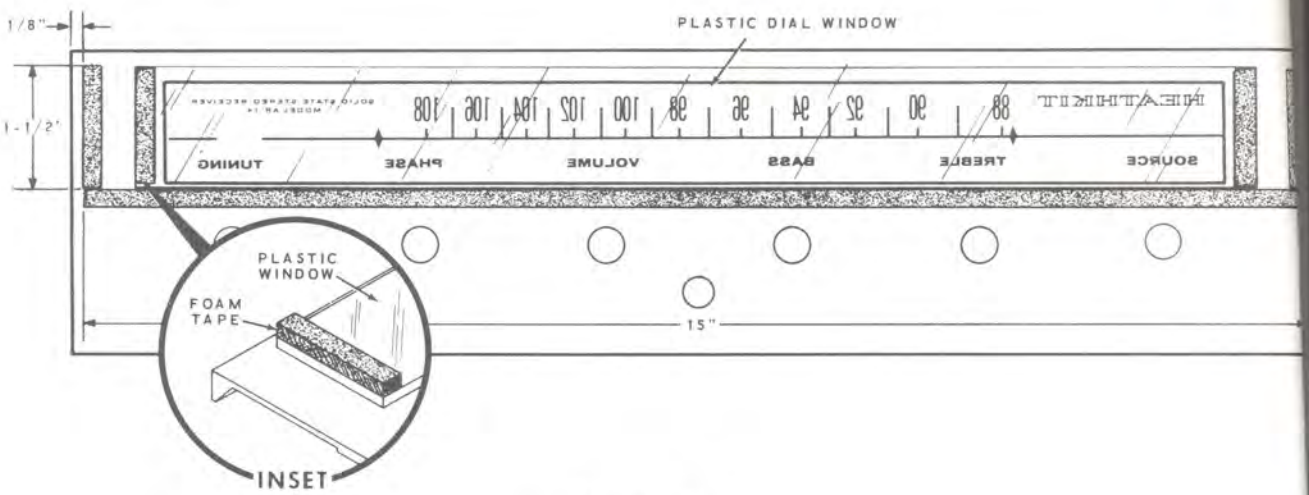
( ) Insert the line cord through hole BC. Connect one lead to lug 1 (S-2) and the other lead to lug 2 (S-3) of socket AD.



Detail 26C

( ) Install the line cord strain relief in hole BC as shown in Detail 26C.

( ) Install the fuse in the fuseholder.



Detail 27A

FRONT PANEL, KNOB, AND DIAL POINTER INSTALLATION

Refer to Detail 27A for the following steps.

In each of the following steps, the foam tape should be installed on the back of the front panel in the following manner: Cut off a length of foam tape and remove the backing paper. Then press the tape in place as directed in the step.

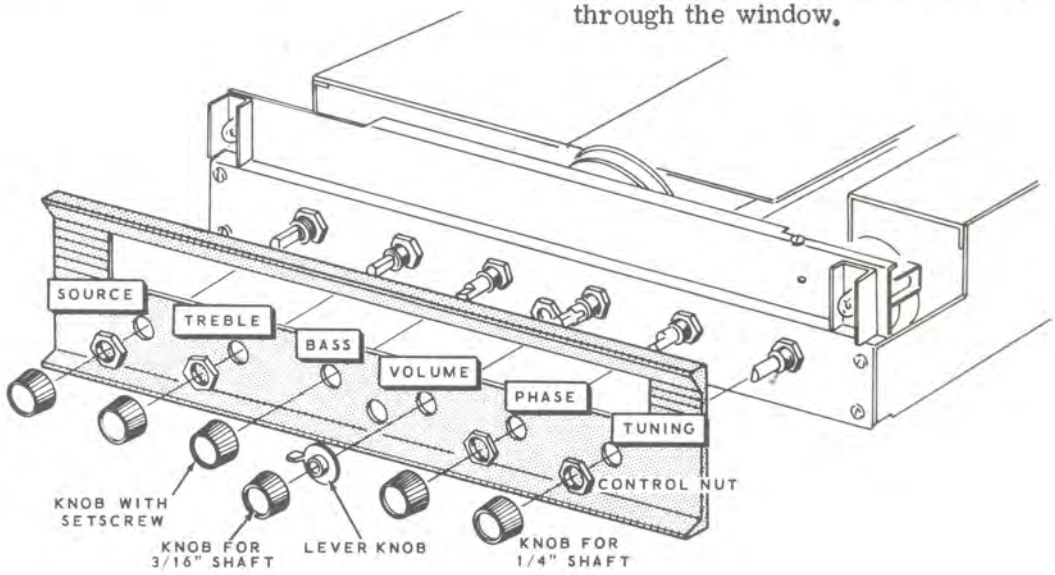
( ) Install 15" of foam tape next to the plastic dial window and 1/8" away from the ends of the front panel, as shown.

( ) Install 1-1/2" of foam tape at each end of the front panel, with the outer edge of the tape 1/8" from the end of the panel, as shown.

( ) Refer to the inset drawing on Detail 27A and install 1-1/2" of foam tape at each end of the plastic dial window. Make sure the tape is on the window and flush with the edge.

Refer to Pictorial 27 for the following steps.

( ) Wipe off the glass before installing the dial window. Also, wipe off that part of the control panel that will be visible through the window.



PICTORIAL 27

( ) Install the front panel on the control panel. Use control nuts on the bushings at Source, Treble, Phase, and Tuning.

( ) Install four knobs for 1/4" shafts at Source, Treble, Phase, and Tuning.

( ) Turn the Treble control fully counterclockwise.

( ) Turn the shaft of the Bass control fully counterclockwise.

( ) Install the knob with the setscrew at Bass. Now position the knob so that the indicator, on the front of it, is in the same position as the indicator on the Treble control. Then tighten the setscrew.

( ) Install the lever knob and the knob for a 3/16" shaft at Volume.

Refer to Pictorial 28 for the following steps.

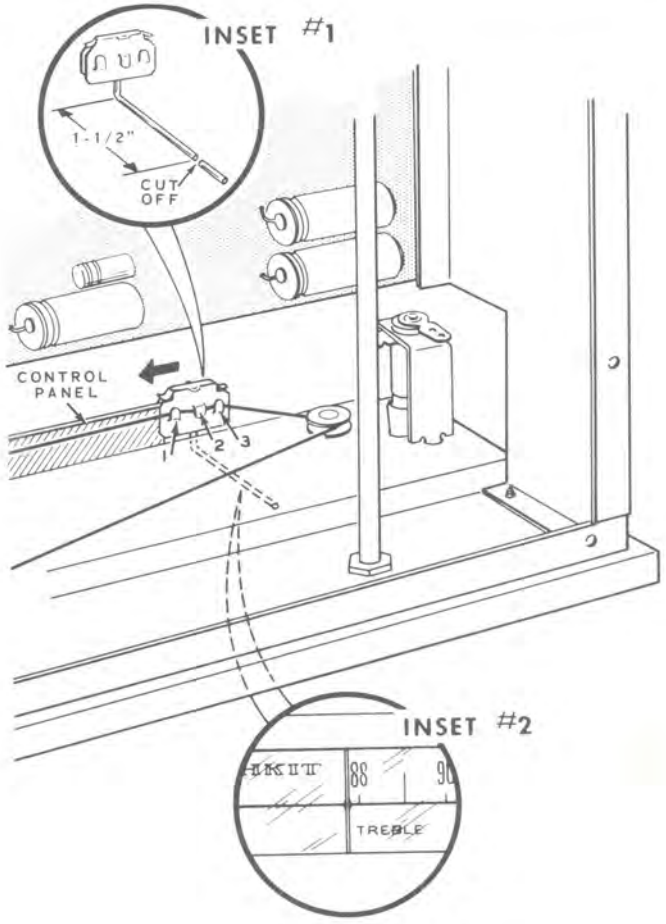
( ) Rotate the tuning control fully counterclockwise until the dial pulley stops turning.

( ) Cut off the end of the dial pointer as shown in inset drawing #1 on Pictorial 28.

( ) Position the Receiver so it rests on the front panel controls.

( ) Slide the dial pointer onto the control panel. Then place the dial cord over hooks 1, 2, and 3 of the pointer.

( ) Position the Receiver so that the front panel faces you. Make sure the Tuning knob is in the full counterclockwise position. Then slide the dial pointer to the diamond shape next to number 88 as shown in Inset #2.



PICTORIAL 28

( ) Rotate the Tuning knob fully clockwise. The pointer should stop at the diamond shape to the right of 108. If it does not, adjust the pointer by sliding it along the dial cord.

This completes the chassis wiring. Carefully inspect the wiring for any unsoldered connections, loose or broken leads, or accidental solder bridges between foils of the circuit boards. Turn the chassis over and shake out any loose bits of solder or wire that may be lodged in the wiring.

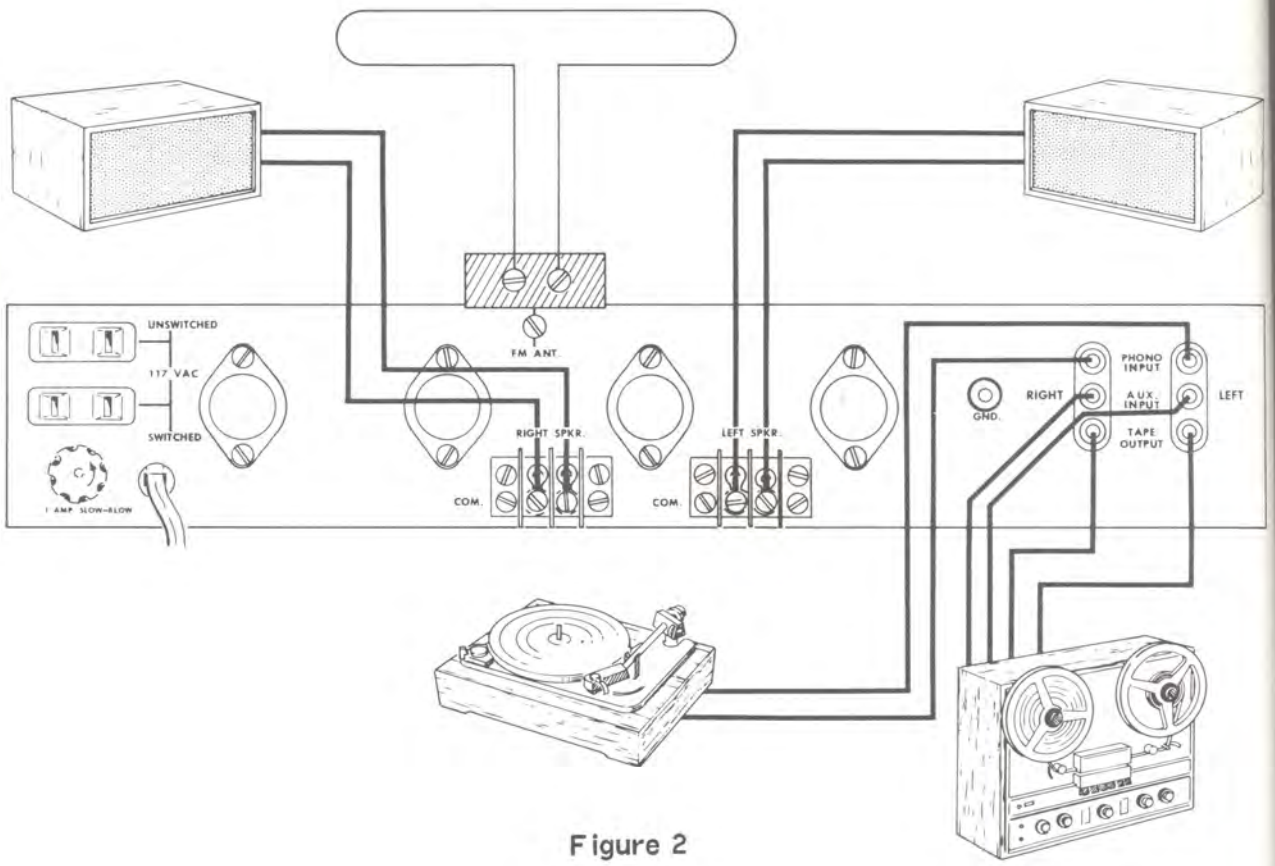


Figure 2

Figure 2 shows how the speakers, antenna, tape recorder, and phonograph are connected to the rear panel of the Receiver.

( ) Speaker connections should be made using good insulated wires such as lamp cord. Install the spade lugs supplied with this kit on the ends of the speaker wires, as shown in Figure 3.

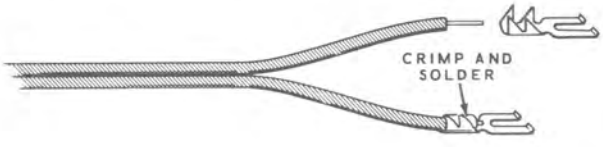


Figure 3

( ) Connect one wire of your left speaker syste under the head of the COM connecting scre of the LEFT SPEAKER output terminal. Co nect the other left speaker wire to the re maining LEFT SPEAKER connecting screw regardless of your speakers impedance

( ) Similarly, connect one wire of your righ speaker system to the COM connecting scre of the RIGHT SPEAKER output terminal Connect the other right speaker wire to th other RIGHT SPEAKER connecting screw regardless of your speakers impedance

NOTE: When installing the Receiver, the speake wires must be ungrounded and no connectio should be made between the left and right speake systems.

( ) Set the controls as follows:

SOURCE switch to PHONO (S).
TREBLE control to maximum counterclockwise.
BASS control to maximum counterclockwise.
VOLUME controls to maximum counterclockwise.
The PHASE and TUNING does not have to be set.

( ) Plug the line cord into a 105 to 125 volt 50/60 cps electrical outlet.

( ) Turn the Receiver on by pulling the TREBLE control knob out. The pilot lamps should light.

( ) Slowly turn the VOLUME controls clockwise until a background hiss is heard from both speakers.

( ) Turn the BASS control clockwise until an increase in low frequency rumble is heard from both speakers. Then return this control to its mid-position.

( ) Turn the TREBLE control clockwise until an increase in high frequency hiss is heard from both speakers. Then return this control to its mid-position.

NOTE: Each input on the rear of the chassis can be checked by inserting a metal probe (such as a narrow screwdriver blade, a short length of solder, a bent paper clip, etc.) into each input socket and listening for a hum from the speaker. The left channel inputs will be checked first.

( ) Turn the VOLUME controls fully counterclockwise, and be sure the SOURCE switch is in the PHONO (S) position.

( ) Insert the metal probe into the LEFT channel PHONO INPUT socket so that it touches the inner contact. While grasping the inserted probe, slowly advance the VOLUME controls a few degrees. A strong hum should be heard from the left speaker.

( ) Make this same test with the RIGHT CHANNEL PHONO INPUT, listening for a strong hum coming from the right speaker.

( ) Turn the SOURCE switch to (S) AUX.

( ) Test the LEFT and RIGHT AUX INPUT in the same way. A strong hum should be heard from the left speaker.

( ) If the Receiver is operating normally, continue with the following adjustments. If the Receiver does not appear to be working properly, refer to the In Case Of Difficulty section on Page 55.

( ) Connect an antenna to the FM ANT terminal strip at the rear of the Receiver. Either an FM or VHF TV antenna can be used. NOTE: The types of antennas recommended for use with the Receiver are described on Page 52 in the Installation section.

( ) Set the SOURCE switch to (M) FM.

( ) Rotate the TUNING knob until an FM station is heard. Tune to a station of known frequency, preferably one that is near the center of the dial.

( ) Hold the tuning knob so this station stays tuned in; then move the dial pointer until it points to the frequency of this station.

( ) Place the OFF-ON switch at the OFF position. This completes the Initial Test.

The IF transformers, ratio detector transformer, and the FM tuning unit have been prealigned at the factory. Therefore, no further adjustments should be needed, and you may proceed to the FM Stereo Adjustments section on Page 48.

However, if the Receiver does not seem to receive that station as clearly as it should, perform the FM Adjustments steps first, to obtain peak performance. These steps can be completed without any test equipment. If any difficulty is encountered during these steps, turn the Receiver OFF and refer to the In Case Of Difficulty section on Page 55.

FM ADJUSTMENTS

Refer to Figures 4 and 5 (fold-out from Page 65) for the locations of the transformers, coils, and test points that are called out in the following steps.

( ) Connect a short jumper wire from point X to point Y on the FM-multiplex circuit board.

( ) Set the controls on the Receiver as follows:

SOURCE switch to (M) FM.
TREBLE control to the middle position.
BASS control to the middle position and pushed in.
VOLUME control to a comfortable listening level.
PHASE control pushed in and fully clockwise.
TUNING does not have to be set.

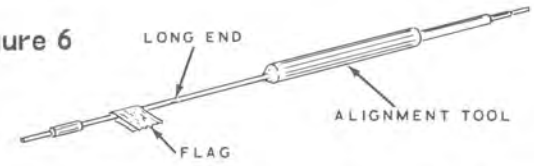
( ) Disconnect the antenna.

( ) POWER ON (TREBLE pulled out).

( ) Turn the tuning dial off station.

NOTE: In the following steps, be careful that you do not turn the slugs of the transformers and coils too far, or instrument alignment may be required. To prevent this from happening, put a flag (piece of tape) on the long end of the alignment tool as shown in Figure 6. The flag will indicate how far the slug has been turned. Use the short end of the tool to turn the slug.

Figure 6



( ) Adjust the top and bottom slugs of IF transformer T2 for the loudest noise in the speakers. Each slug should not be adjusted more than one full turn in either direction. NOTE: The bottom slug can be reached from the foil side of the circuit board.

( ) Connect the antenna to the ANTENNA terminal strip, and tune in an FM station that has a weak, noisy signal.

( ) Remove the jumper wire that is connected between points X and Y on the circuit board. The station should stay tuned in after the wire is removed. If the tuning changes, adjust the top slug of transformer T6 a slight amount until the sound output of the same station is maximum again.

After ratio detector transformer T6 is properly adjusted, the AFC (automatic frequency control) circuit will function properly and the Receiver will stay tuned to a station. IF transformers T3, T4, and T5 should not be adjusted except when instruments are used to align the Receiver.

FM STEREO ADJUSTMENTS

Refer to Figures 4 and 5 (fold-out from Pa 65) for the transformer and coil locatio

( ) Set the SOURCE switch to (S) FM th tune in a station that is known to be broa casting a stereo signal.

( ) Pull the PHASE control out and turn fully clockwise.

( ) Reposition the stereo indicator lamp so is directly behind the opening in the di plate. Then adjust coil L7 for maximu brightness of the stereo indicator lamp. N more than two complete turns of the sl should be required. NOTE: The sound ou put may be distorted after completing th adjustment.

NOTE: Complete the following adjustments ve carefully to obtain good stereo listening.

( ) Adjust transformer T7 as follows:

1. Carefully turn the slug (not more th one turn in either direction) until t sound output is clear.

2. Now turn the slug counterclockwise the point where the sound output ju starts to become garbled. Note t position of the flag on the alignme tool.

3. Turn the slug clockwise 1/4 tur

( ) Readjust coil L7 until a null or minimu sound output is obtained. NOTE: If there a two nulls, use the null adjustment that closer to the top of the coil. The prope adjustment should be close to the point maximum brightness of the stereo indica tor lamp.

( ) Turn the PHASE control counterclockwi until the point of maximum sound output obtained, then push the PHASE control i

The FM stereo circuit is now adjusted f minimum distortion and maximum separatio This completes the Adjustments.

FINAL ASSEMBLY

Refer to Pictorial 29 for the following steps.

( ) Install #6 x 1/4" sheet metal screws at BH and BJ.

( ) Install 6-32 x 3/8" self-tapping screws at BR and BS. These screws fasten into the transformer shield.

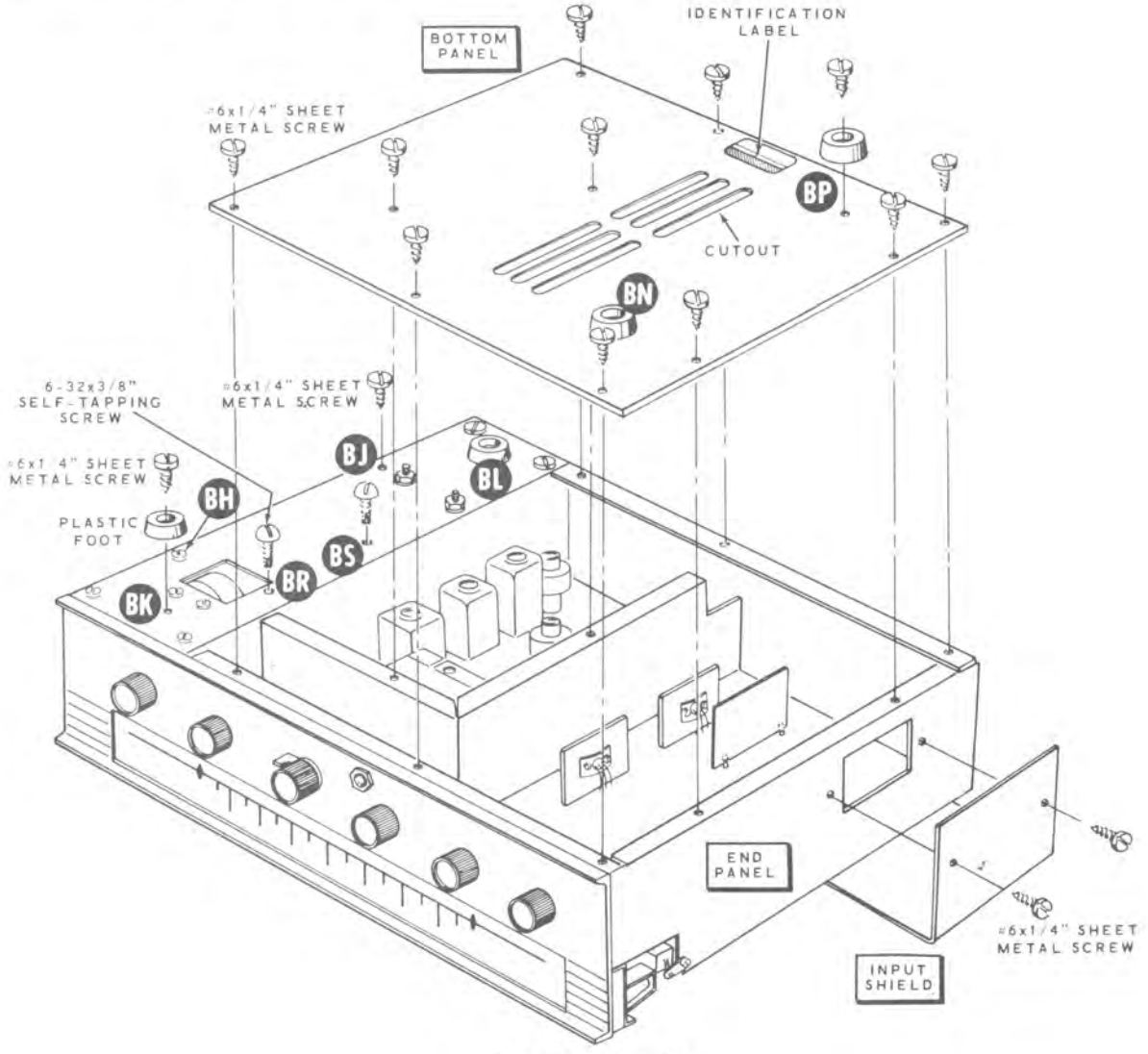
( ) Mount plastic feet at BK and BL with #6 x 1/4" sheet metal screws. Do not overtighten the screws.

( ) Position the bottom panel on the chassis with the cutouts and two center mounting holes as shown. Fasten the bottom plate to the chassis with ten #6 x 1/4" sheet metal screws.

( ) Mount plastic feet at BN and BP with #6 x 1/4" sheet metal screws. Do not overtighten the screws.

( ) Remove the backing paper from the blue and white identification label. Install the label on the bottom panel near location BP.

( ) Mount the input shield to the end panel with #6 x 1/4" sheet metal screws.



PICTORIAL 29

INSTALLATION

The Receiver can be installed in either of the following Heathkit Accessory Cabinets: The AE-55 Walnut Cabinet, or the AE-65 Metal Cabinet.

If preferred, the Receiver can be custom mounted without a cabinet in either a vertical or horizontal position. If the Receiver is custom mounted, it may be necessary to remove the plastic feet before mounting it. Always mount the Receiver so the weight is not supported by the front panel. See Figure 7.

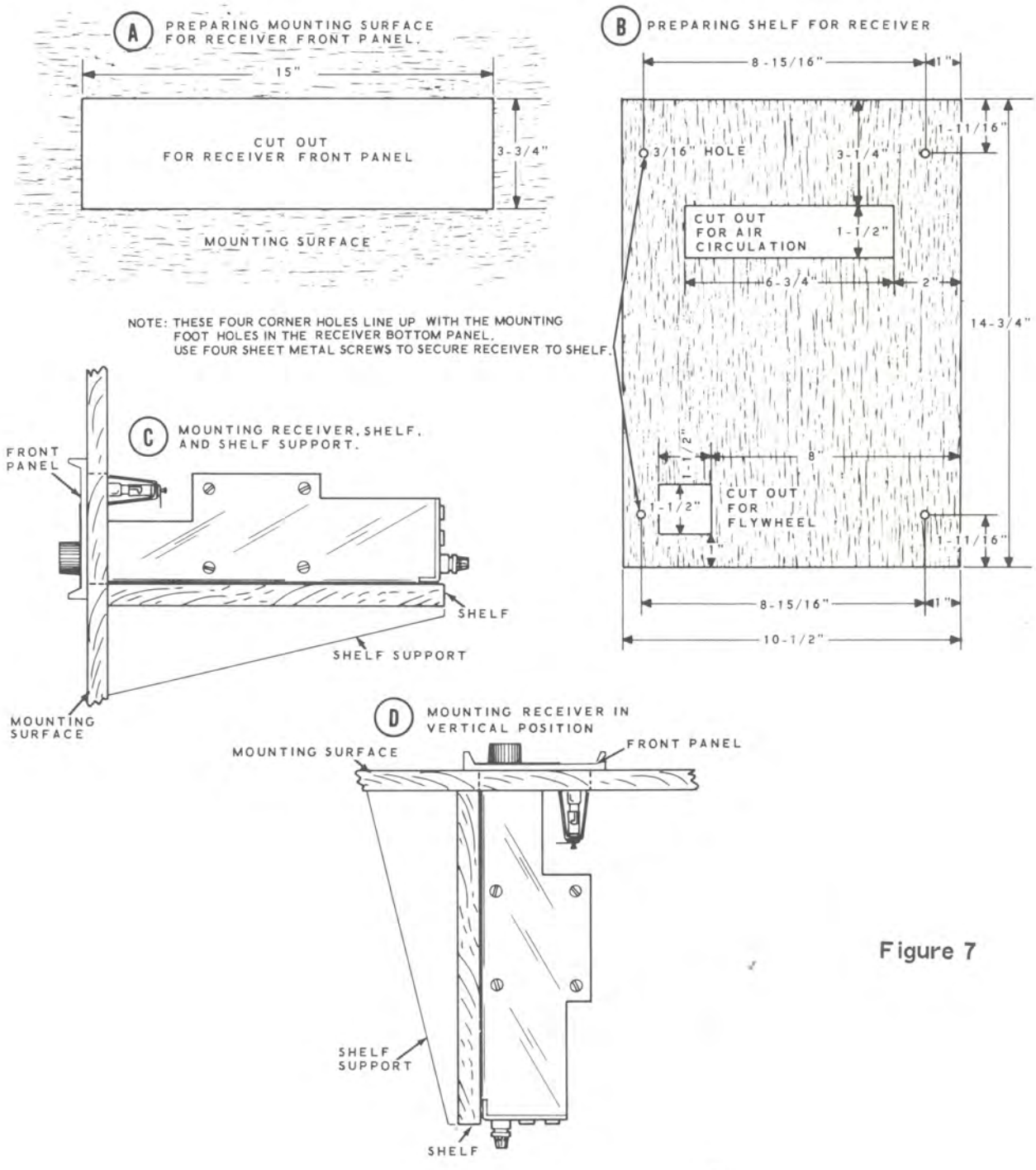


Figure 7

INPUT CONNECTIONS

Shielded cables, terminated in standard phono plugs, should be used to connect all signal sources to the input sockets of your Receiver. The following information gives the correct input connections for the various types of signal sources.

Phono Input

For magnetic or variable reluctance phono cartridges.

Auxiliary Input

For use with most high level signal sources such as a television receiver or tape recorders with preamplifier output. A record changer or a turntable equipped with a crystal or ceramic stereo cartridge may also be connected to the AUX INPUTS. However, the BASS control should be turned up in order to compensate for the low frequency losses when using these cartridges.

Ground Terminal

In some cases the mechanism of a turntable or a changer is not connected to the audio cable shield. To reduce hum in these cases, a separate ground wire should be connected from the turntable to this ground terminal.

TAPE OUTPUT

When connecting this Amplifier to a tape recorder, the high level input of the recorder should be used. This input is sometimes called High Level, Radio, or Line Input. AT NO TIME SHOULD A TAPE RECORDER BE CONNECTED TO THE AMPLIFIER SPEAKER CONNECTIONS, as serious damage could result to the Receiver.

AC OUTLETS

Switched AC Outlet

For supplying power to devices such as record changers, which may then be controlled by the On-Off switch on the Amplifier.

Normal AC Outlet

For supplying power to devices such as record changers or tape decks, which may be damaged if power is removed without turning off the mechanism.

SPEAKER CONNECTIONS

( ) If your left speaker has a lug marked "common," or C, connect a wire from this lug to the COM (common) connecting screw of the LEFT SPEAKER output terminal. If your left speaker lugs are not marked, connect a wire from either of these lugs to the LEFT SPEAKER output terminal.

( ) Connect the other left speaker wire to the other LEFT SPEAKER connecting screw.

( ) If your right speaker has a lug marked "common," or C, connect a wire from this lug to the COM (common) connecting screw of the RIGHT SPEAKER output terminal. If your right speaker lugs are not marked, connect a wire from either of these lugs to the RIGHT SPEAKER output terminal.

( ) Connect the other right speaker wire to the other RIGHT SPEAKER connecting screw.

Speaker Phasing

NOTE: If the "common" lugs of your left and right speakers were marked, this phasing procedure can be disregarded; the connections made in the preceding steps provided proper phasing for your speakers.

The two speakers should be connected so that they are "in-phase." "In-phase" means that both speaker cones move in the same direction at the same time, when driven by identical signals. (If multiple-speaker systems are used, phasing refers to the low-frequency speaker in each system.)

Speaker phasing can be determined easily in the following manner: Disconnect both phono input cables, and set the SOURCE switch to the PHONO (M) input. Introduce a hum in both channels by inserting a length of bare wire or a screwdriver in one of the empty input sockets; then advance the VOLUME controls until a hum is heard.

Place the speakers side by side. Note the loudness of the hum when you stand directly in front of and between the speakers. Now interchange the two speaker wires on one channel. When the loudest hum is heard the speakers are in phase.

Speaker Placement

Generally, for stereo listening, the two speakers should be spaced four to eight feet apart. They should be placed along a wall either facing straight ahead or "firing in" slightly toward each other's axis. The optimum positions can best be determined by experiment. A great deal depends upon the size and acoustics of the room and upon the high frequency dispersion characteristics of the speakers. Identical speakers or speaker systems are recommended.

Correct speaker spacing also depends to some extent upon the listener's position and distance from the speakers. In other words, if the listening position is restricted to one that is relatively close to the speakers, some improvement could probably be obtained by moving the speakers closer together.

Remember that stereophonic reproduction is striving to recreate, as accurately in position as possible, not only the sounds that originate at the "right" or "left", but also those near the center. Best results will be obtained if you experiment with speaker and listening positions; this will help you arrive at the best set of conditions for your installation.

Stereo Headphone Jack

A set of stereo headphones can be plugged directly into this jack. The external speakers are disconnected when the switch on the BASS control is pulled out. Program material can be tape recorded by plugging the high level input of the tape recorder into this jack.

Figure 8 shows a type of plug that can be installed on the end of a stereo headphone or tape recorder cable. The tip of the plug connects to the right channel of the jack.

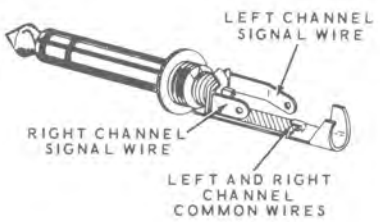


Figure 8

INDOOR ANTENNAS

Several types of indoor TV and FM antennas are available that will provide satisfactory mono FM operation of the Receiver in strong signal areas, or from strong local stations. For stereo FM however, an outdoor antenna should be used.

A simple folded dipole antenna can be made as shown in Figure 9, from standard 300 Ω twin lead. This antenna can be placed on the rear of a large cabinet or nailed or stapled to a piece of wood to reinforce it. Best reception will be obtained from the stations that are broadside to this antenna. Weakest reception will occur with those stations that face the ends of the antenna.

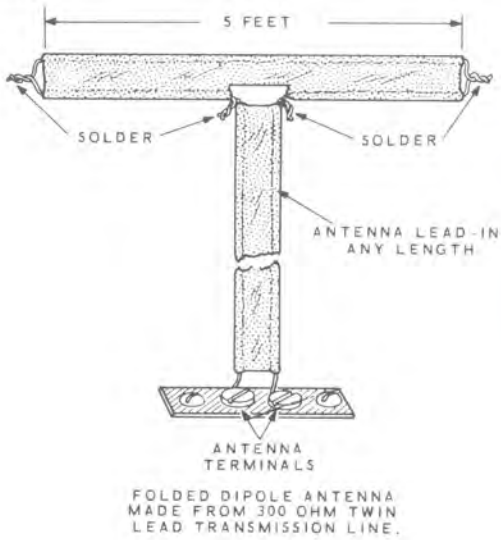


Figure 9

OUTDOOR ANTENNAS

To receive weaker stations, or in weak signal areas, an outdoor antenna will be necessary. BEST RECEPTION FOR STEREO FM WILL OCCUR WITH A COMMERCIAL FM OUTDOOR ANTENNA. A VHF TV antenna can also be used as an FM antenna, since FM stations are actually located between TV channels 6 and 7.

Do not connect a TV antenna to both the TV set and the Receiver at the same time, unless a TV antenna coupler is used, or a weak and distorted signal may occur in both units. Pad type couplers are not recommended because large amounts of signal are lost in them. Use a preamplifier type of coupler instead, where there is no loss of signal.

OPERATION

Refer to Figure 10 for the location of the front panel controls.

SOURCE SWITCH

NOTE: This is a three wafer switch; it allows the inputs of both channels to be selected simultaneously. It also turns the 38 kc oscillator off when inputs other than stereo FM are used.

When the SOURCE switch is in one of the monophonic (M) positions, the input signals from both the left and right channels will be combined and heard in both the left and right speakers. In the stereo (S) positions, all signals from the left Channel Inputs will be heard only in the left speaker, and all Right Channel signals will be heard only in the right speaker.

In the monophonic (M) FM position, the same signal is present at the Left and Right output sockets. In the stereo (S) FM position (when tuned to a station that is broadcasting stereo), one channel signal is heard in the left speaker and the other channel signal is heard in the right speaker.

NOTE: The (S) FM position should only be used when a station is broadcasting stereo; otherwise, subchannel noise may be heard on regular FM programs. Also, noise may be heard from stations that broadcast a Subsidiary Communications Authorization (SCA) signal.

VOLUME

The dual-concentric clutched VOLUME control allows the listening level of each channel to be adjusted simultaneously or individually. Maximum volume is obtained when the knobs are rotated fully clockwise.

BASS CONTROL AND SPEAKER ON-OFF SWITCH

The BASS control is of dual-tandem construction. The low frequency response is simultaneously varied by the same amount in both channels. Flat response is obtained when the knob is at approximately 12 o'clock. Clockwise rotation produces boost, and counterclockwise rotation produces cut of the low frequencies. Pulling the control knob out, disconnects the speakers and allows private listening with headphones.

TREBLE CONTROL AND POWER ON-OFF SWITCH

The TREBLE control is of dual-tandem construction. The total response is simultaneously varied by the same amount in both channels. Flat response is obtained when the knob is at approximately 12 o'clock. Clockwise rotation produces boost, and counterclockwise rotation produces cut of the high frequencies.

The On-Off switch is located on the TREBLE control. Pull the TREBLE control knob out to turn the Receiver ON, and push the knob in to turn it OFF.

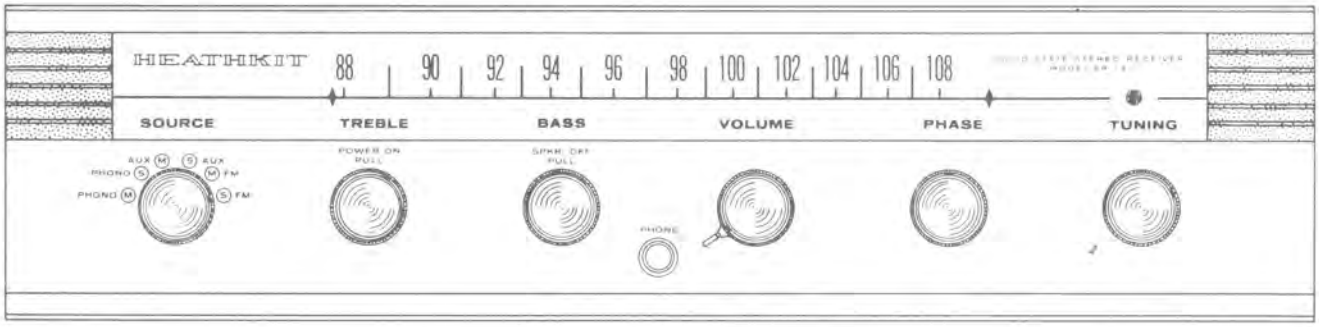


Figure 10

TUNING

This control changes the dial setting and tunes in the desired station.

STEREO INDICATOR LAMP

This indicator will light with a steady glow when an FM station that is broadcasting a stereo signal is tuned in, if the SOURCE switch is in the Ⓢ FM, Ⓜ FM, Ⓢ AUX, or Ⓜ AUX positions. Note that in some cases it may flicker on and off due to the noise between stations. It may also light for short periods of time on stations that use a "Commercial Killer" signal. This signal eliminates the commercials from the music that these stations sell to business establishments.

PHASE CONTROL AND SWITCH

This control and switch is only used when tuned to a station that is broadcasting an FM stereo signal. The SOURCE switch must be set at the Ⓢ FM position. When you tune to different stations, the Phase control will produce maximum stereo separation by correcting any transmitted phase errors.

To set the PHASE control, pull the knob out to activate the switch, and adjust the control in either direction for the loudest output signal. Then push the knob back in without disturbing the control setting.

HOW TO GET THE MOST OUT OF YOUR RECEIVER

Use the following procedure to get the greatest possible enjoyment out of this high quality Stereo Receiver. The Receiver should be connected to good quality speakers. The speakers should be placed far enough apart to provide good stereo separation; approximately 4 to 8 feet.

Set the SOURCE switch to the Ⓢ FM position.

Tune in a station that is broadcasting stereo, as indicated by a steady glow of the stereo indicator lamp.

Pull out the PHASE control knob and adjust this control in either direction for the loudest output. Then push the knob back in without disturbing the setting of this control.

NOTE: The Phase control adjusts the phase of the 38 kc reinserted carrier. It may be necessary to readjust this control when tuning to another station, to correct transmitted phase errors and obtain maximum stereo separation.

Set the SOURCE switch to the Ⓜ FM position.

Adjust the volume controls to produce an equal sound level from each speaker at the desired listening level.

To receive monophonic FM programs, always set the SOURCE switch to the Ⓜ FM position. This will produce the best signal-to-noise ratio.

IN CASE OF DIFFICULTY

This section of the manual is divided into three parts: Visual Test, Precautions For Bench-Testing, and the Troubleshooting Chart. Begin your search for any trouble that occurs after assembly by carefully following the checks listed in the Visual Tests section. After visual tests are completed, refer to the Troubleshooting Chart.

Refer to the Service and Warranty sections of the Kit Builders Guide in an extreme case, when you are unable to resolve the difficulty.

NOTE: Refer to the Circuit Board X-Ray Views and photos on Pages 76 through 79 for the physical location of parts on the circuit boards and on the chassis.

VISUAL TEST

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.

2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Soldering section of the Kit Builders Guide.

3. Check to be sure that all transistors are in their proper locations. Make sure each transistor lead is connected to the proper point.

4. Check the values of the parts. Be sure in each step that the proper part has been wired into the circuit, as shown in the pictorial diagrams. It would be easy, for example, to install a 22 KΩ (red-red-orange) resistor where a 220 KΩ (red-red-yellow) should have been installed.

5. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.

If the trouble is still not located after the visual tests are completed, and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram and voltage drawings (Figure 17 and 18 on Pages 74 and 75). NOTE: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as ±20%.

NOTE: A review of the Circuit Description may help you determine where the trouble is.

PRECAUTIONS FOR BENCH TESTING

1. Be cautious when testing transistor circuits that you do not operate the transistors beyond their limits. Although the transistors have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than tubes. A vacuum tube, for instance, can often be operated under shorted, zero-bias, excessive-voltage, or high-current conditions for short periods of time without materially damaging the tube, but any one of these same conditions can completely destroy a transistor instantaneously.

2. Be sure you do not short any terminals to ground when making voltage measurements. If the probe should slip, for example, and short out a bias or supply point in the power output stage, it is almost certain to cause damage to one or more transistors or diodes.

3. Be sure the connections to the test equipment are not crossed, thereby introducing a short circuit across the amplifier output (SPKR) terminals. This could also damage one or more transistors or diodes.

4. Transistors should be inserted or removed only while the Receiver is turned off. If this rule is not followed, transistors may be damaged.

TROUBLESHOOTING CHART

DIFFICULTY	POSSIBLE CAUSE
Receiver completely dead. Dial lamps not on.	1. Open AC line cord. 2. Blown fuse. 3. Faulty Off-On switch. 4. Defective power transformer.
Noise output only, no audio signal.	1. Check antenna. 2. Local oscillator Q3 not operating.
No sound, dial lamps on.	1. Phase control knob pulled out. 2. Open or shorted output cables. 3. No B+ voltage. 4. Faulty silicon diode D200, D201, D202, or D203. 5. Open resistor R201. 6. Faulty filter capacitor, C202 or C203. 7. Choke L5 open. 8. Improper operation of one of the following transistors: Q1 through Q9.
Distorted output signal.	1. Misalignment of ratio detector transformer T6. 2. Faulty transformer T6. 3. Shorted capacitor C40, C43 or C52. 4. Check FM alignment.
AFC circuit does not operate.	1. Check alignment of transformer T6. 2. Open or shorted diode D1.
Non-linear AFC action.	1. Check alignment of transformer T6. 2. Defective diode D1.
FM all right, no FM stereo, stereo indicator lamp does not light.	1. Program is not stereo. 2. Open stereo indicator lamp. 3. Check alignment of coil L7. 4. Open or shorted coil L7.
FM all right, no FM stereo, but stereo indicator lamp lights.	1. Check adjustment of Phase control. 2. Check adjustment of transformer T7. 3. Open or shorted transformer T7. 4. Shorted capacitor C48 or C49. 5. Improper operation of transistor Q10.

DIFFICULTY	POSSIBLE CAUSE
Stereo signal garbled or whistles.	1. Check adjustment of transformer T7. 2. Shorted or open capacitor C46. 3. Open capacitor C47.
Phase control does not adjust properly.	1. Open or shorted coil L8. 2. Faulty part or wiring in Phase control and switch circuits. 3. Shorted or open capacitor C45. 4. Improper adjustment of coil L7.
Little or no FM stereo separation.	1. Not tuned to stereo program. 2. Phase switch in the out position. 3. Misadjustment of transformer T7 and/or Phase control. 4. Improper operation of transistor Q11 or Q12.
Loud background noise.	1. FM signal too weak; a better antenna is needed. 2. Check adjustment of coil L6. 3. Open or shorted capacitor C40. 4. Open or shorted coil L6.
No sound, dial lamps do not light.	1. Line cord not plugged in. 2. Defective fuse. 3. Defective On-Off switch. 4. Wiring error on power transformer or diodes D200, D201, D202, D203.
Sound ok; dial lamps do not light.	1. Open filament on one of the (or both) lamps. 2. Resistor R200 defective.
No sound in either channel.	1. Source switch in wrong position. 2. Volume control turned fully counterclockwise. 3. Defective speakers or speaker cables. 4. Defective audio signal cable or signal source. 5. Wiring error on phone jack. 6. Measure all voltages.
No sound in one channel only.	1. Refer to steps 1 through 6 above. 2. Defective transistor; measure voltages.

DIFFICULTY	POSSIBLE CAUSE
Hum	1. Reverse AC line cord in the outlet. 2. Defective shield on audio cable. 3. No ground wire between ground terminal on Receiver and turntable base plate when using Phono input. 4. Intermittent ground in Receiver. Check for loose hardware or poor solder connections. 5. Transistor Q100 faulty.
Low supply voltage at points [E] and [F].	1. Transistor Q100 open. Before replacing Q100, check resistance reading from Test Point E to chassis ground. (See Initial Test, Page 44.) 2. Short in preamplifier circuit, Q100.
Supply voltage on transistors Q15 and Q16 near point A supply voltage.	1. Check wiring and components in circuits of transistors Q15 and Q16. 2. Transistor Q15 or Q16 shorted. Measure resistance between the Emitter and Collector leads on lowest range. Zero ohms regardless of ohmmeter lead connection, indicates a short.
Supply voltage on transistors Q15 and Q16 very low or zero.	1. Check wiring of transistors Q15 and Q16. 2. Resistor R169 or R170 open.

ALIGNMENT WITH INSTRUMENTS

This alignment procedure requires the use of test equipment. It should only be performed by those who have instrument alignment experience.

IF ALIGNMENT

Equipment needed: A high impedance input DC VTVM, and an RF generator that is accurate at 10.7 mc. A Heathkit VTVM and the Heathkit FMO-1 Test Oscillator, or their equivalents, may be used.

( ) Set the Receiver controls as follows:

SOURCE switch to (M) FM.
PHASE switch pushed in.
TUNING to low frequency end of dial.

Refer to Figures 4 and 5 (fold-out from Page 65) for coil, transformer, and TP (test point) locations. Complete the adjustments given in the Alignment Chart below.

IF ALIGNMENT CHART

PREPARATION	RF GENERATOR		VTVM	ADJUST	
	Connect To	Frequency And Output	Connect To	Transformer	For VTVM Reading
Connect a jumper wire between points X and Y on the FM-Multiplex circuit board.	Antenna input terminals.	10.7 mc (without modulation). Set generator output for 2 volts on VTVM.	TP1	Bottom slug of T6	Maximum reading.
		10.7 mc (without modulation). Reduce generator output to maintain 2 volts on VTVM.	TP1	Top and bottom slugs of T5	
				Top and bottom slugs of T4	
				Top and bottom slugs of T3	
				Top and bottom slugs of T2	
				Repeat each step above until no further improvement is obtained.	
			TP2	Top slug of T6	Zero reading.
Remove jumper wire from between points X and Y.	Antenna input terminals.	10.7 mc without modulation.	TP2	If necessary, readjust top slug of T6.	

FRONT END ALIGNMENT

Equipment needed: An RF generator and a high input impedance DC VTVM.

Complete the steps in the following Alignment Chart.

FRONT END ALIGNMENT CHART

STEP	RF GENERATOR		CONNECT VTVM TO	RECEIVER TUNED TO	ADJUST FOR MAXIMUM VTVM READING
	Connect To	Frequency And Output			
1.	Antenna terminals. NOTE: It may be necessary to loosely couple RF generator leads to Tuner input.	90 mc	TP1	To maximum reading near 90 mc	T1
2.	Readjust the dial pointer so it coincides with the 90 mc marking on the dial.				
3.	Antenna terminals	106 mc	TP1	106 mc	C14
4.	Antenna terminals	106 mc	TP1	106 mc	C1 and C6
5.	Repeat steps 1, 3, and 4 until no further improvement can be obtained.				

STEREO ALIGNMENT

Equipment needed: Audio generator and AC VTVM. The Heathkit Models IG-72 or IG-82 Audio Generators and the Model IM-21 AC VTVM, or their equivalents may be used.

( ) Disconnect the negative lead of capacitor C39 from the circuit board at point R. See Figures 4 and 5 (fold-out from Page 65).

Complete the steps in the Stereo Alignment Chart and the steps that follow the chart.

STEREO ALIGNMENT CHART

PREPARATION AND CONTROL SETTINGS	AUDIO GENERATOR		VTVM	ADJUST	
	Connect To	Frequency And Output	Connect To	Coil	For VTVM Reading
SOURCE switch to (M) FM. PHASE switch pulled out.	Negative (-) lead of capacitor C39.	38 kc (±200 cps) .01 volt rms output.	TP3	L8	Maximum reading (about .2 volt rms).
Push PHASE switch in. Adjust PHASE control to about 2 o'clock position.		67 kc .1 volt rms output.		L6	Minimum reading (about .007 volt rms).

( ) Disconnect the AC VTVM and the audio generator from the Receiver.

( ) Reconnect the negative (-) lead of capacitor C39 to the circuit board at point R and solder the connection.

NOTE: To obtain the most accurate alignment, coil L7 and transformer T7 should be adjusted by using an FM stereo broadcast signal, rather than by using instruments.

( ) Adjust coil L7 and transformer T7 by completing the steps under FM Stereo Adjustments on Page 48.

This completes the Stereo Alignment.

CHANNEL SEPARATION TESTS

If an FM stereo generator is available, this generator may be used to check channel separation. To check separation, coil L7 and transformer T7 must be adjusted as outlined in the following steps.

Equipment needed: FM stereo generator and AC VTVM. If desired, an oscilloscope may also be used.

( ) Disconnect the negative (-) lead of capacitor C39 from the circuit board at point R.

( ) Connect the FM stereo generator output lead to the negative (-) lead of capacitor C200.

( ) Connect the AC VTVM (and oscilloscope if desired) to the RIGHT TAPE OUTPUT socket of the Receiver.

( ) Set the SOURCE switch on the Receiver to the (S) FM position.

( ) Set the FM stereo generator to the right channel output and use the 19 kc pilot signal with a 1 kc multiplex signal.

( ) Adjust coil L7 for maximum brilliance of the stereo indicator lamp.

( ) Pull out the PHASE switch, then adjust the PHASE control fully clockwise.

NOTE: Complete the following adjustments very carefully to obtain good stereo listening.

( ) Adjust transformer T7 as follows:

1. Turn the slug (not more than one turn in either direction) until the sound output is clear.

2. Turn the slug counterclockwise to the point where the sound output just starts to become garbled. Note the position of the flag on the alignment tool.

3. Turn the slug clockwise 1/4 turn.

( ) Readjust coil L7 until a null or minimum sound output is obtained. NOTE: If there are two nulls, use the null adjustment that is closer to the top of the coil. The proper adjustment should be close to the point of maximum brightness of the stereo indicator lamp.

( ) Turn the PHASE control counterclockwise for a maximum output reading, then push the PHASE switch in.

( ) Note the output reading on the VTVM. Then change the FM stereo generator to the left channel output and note the VTVM output reading for this position. The difference between the two output readings is the right channel separation, usually expressed in db (decibels).

( ) Disconnect the VTVM (and oscilloscope if used) from the RIGHT TAPE OUTPUT socket and connect it to the LEFT TAPE OUTPUT socket of the Receiver.

( ) Turn the channel switch of the FM stereo generator to the right channel position, then to the left channel position. Note the output reading on the VTVM for each position. The left channel separation is the difference between these two readings.

( ) Disconnect the FM stereo generator, AC VTVM, and oscilloscope (if used) from the Receiver.

( ) Reconnect the negative lead of capacitor C39 to the circuit board at point R; then resolder the connection.

This completes the Channel Separation Tests.

SPECIFICATIONS

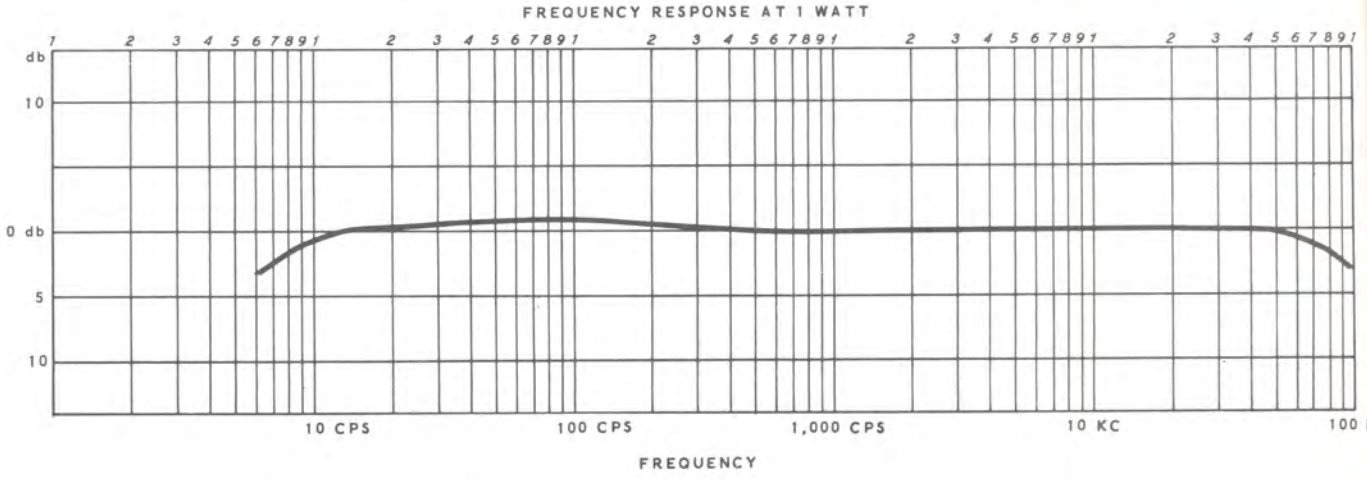
FM SECTION

Tuning Range	88-108 mc.
Antenna Input Impedance	300 Ω, balanced input.
Sensitivity	5 microvolts.*
Intermediate Frequency (IF)	10.7 mc.
Hum And Noise	-50 db, 1 watt reference.
Audio Frequency Response	Monophonic: 0 to -3 db from 20 to 15,000 cps.
Harmonic Distortion	1% or less.*
Image Ratio	-45 db.*
Capture Ratio	3 db.*
AFC Correction	150 kc per volt.
AM Suppression	-35 db.*
IF Rejection	-80 db.*
Separation	30 db at 1000 cps.

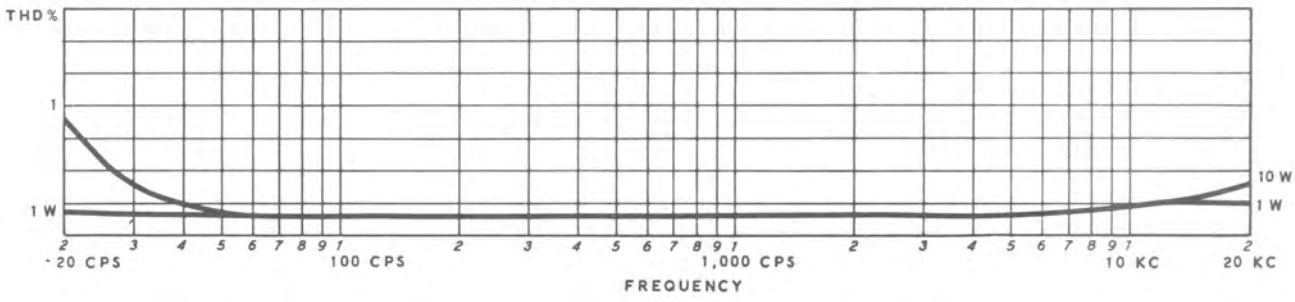
AMPLIFIER SECTION

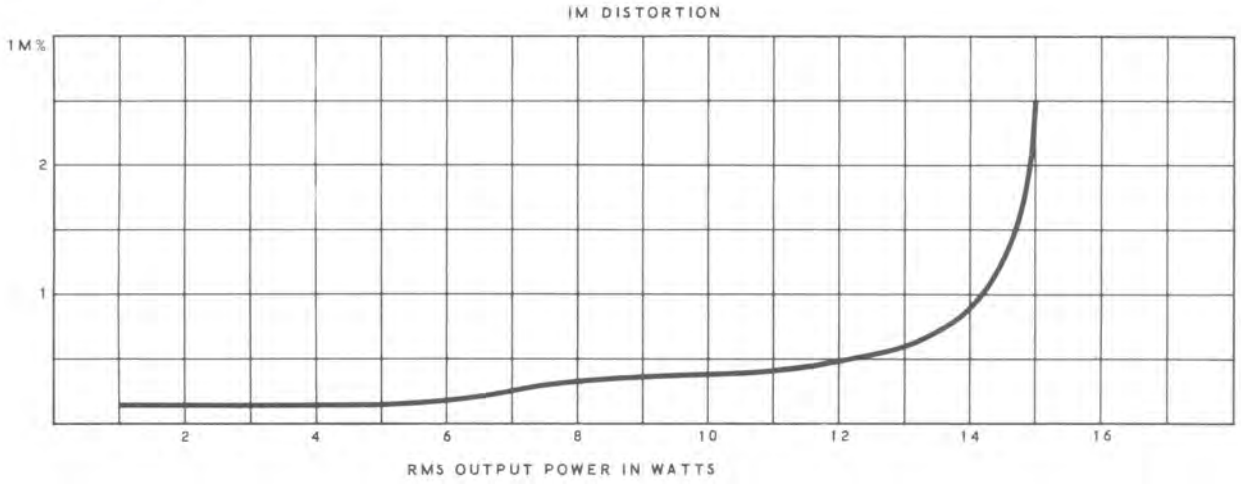
Continuous Power Output	10 watts per channel.
Music Power Output	15 watts per channel.*
Speaker Output Impedance	4 through 16 Ω.
Tape Output Impedance	3500 Ω.
Damping Factor	50 or higher.
Hum And Noise	Phono: -60 db; 10 MV reference-input shorted. Auxiliary: -63 db; input shorted.

*Rated IHF (Institute of High Fidelity) Standards.



Frequency Response. . . (1 watt).	12 to 60,000 cps ±1 db. 6 to 100,000 cps ±3 db.
Power Response. . (10 watt).	15 to 50,000 cps ±1 db. 7 to 90,000 cps ±3 db.
Input Sensitivity.	Phono: 4-1/2 millivolts. Auxiliary: 300 millivolts.
Input Impedance.	Phono: 47 KΩ. Auxiliary: 180 KΩ.
Channel Separation.	45 db or better.
Total Harmonic Distortion (at full output).	Less than 1% from 20 to 20,000 cps.





Intermodulation Distortion (at full output).	Less than 1%, using 60 and 6000 cps mixed 4:1.
Phono Equalization.	RIAA (Recording Industry Association of America).

FRONT PANEL CONTROLS

Source Switch.	Six positions: Mono Phono, Stereo Phono, Mono Auxiliary, Stereo Auxiliary, Mono FM, Stereo FM.
Volume Control.	Dual concentric control.
Bass Control	-16 db cut and 15 db boost at 20 cps (push-pull Speaker switch on rear of Bass control).
Treble Control.	-13 db cut and 15 db boost at 20,000 cps.
Phone Jack.	3-conductor stereo type.

REAR PANEL

Fuse.	1 ampere, slow-blow.
AC Power Socket.	Switched: 117 volts AC, 285 watts. Unswitched: 117 volts AC, 350 watts.
Speaker Terminals.	Right Speaker. Left Speaker.
Left Input Sockets.	Phono. Auxiliary (AUX).

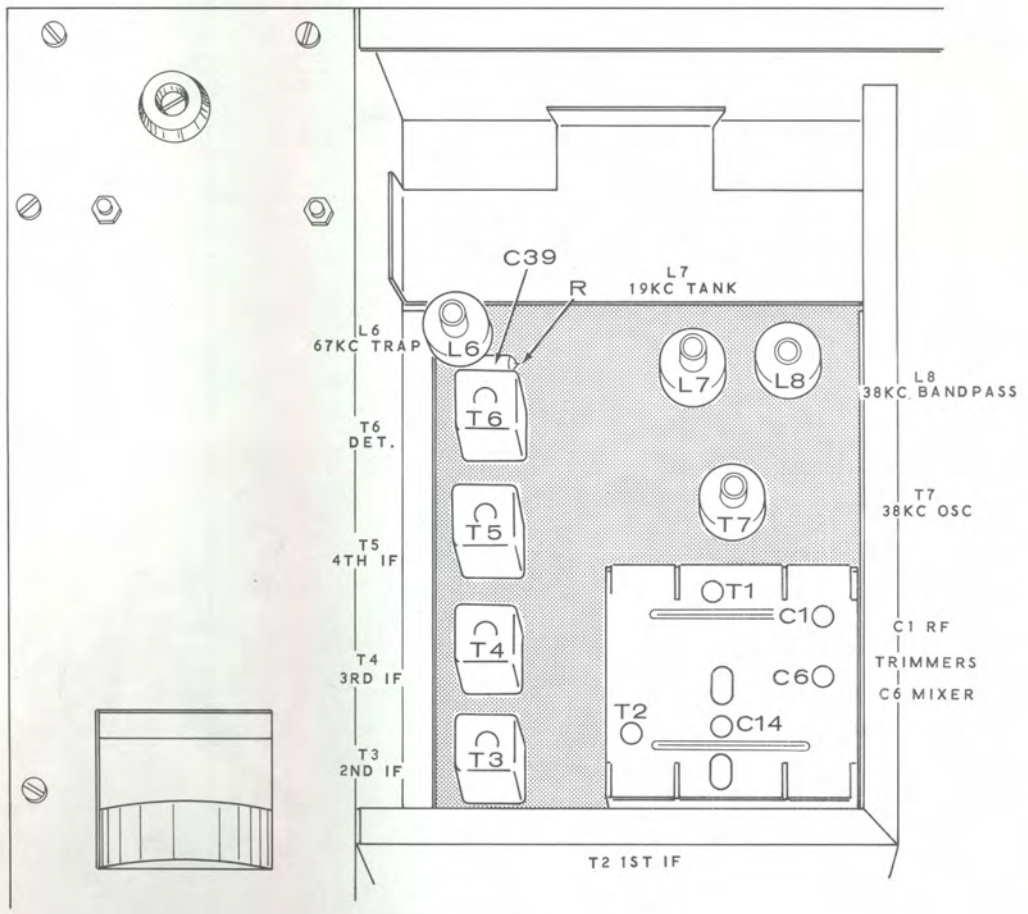

C39
R
L7
19KC TANK
L6
67KC TRAP
L6
L7
L8
L8
38KC BANDPASS
T6
DET.
T6
T7
38KC OSC
T5
4TH IF
T5
T7
T1
C1
C1 RF
TRIMMERS
C6 MIXER
T4
3RD IF
T4
C6
T2
C14
T3
2ND IF
T3
T2 1ST IF

FIGURE 4

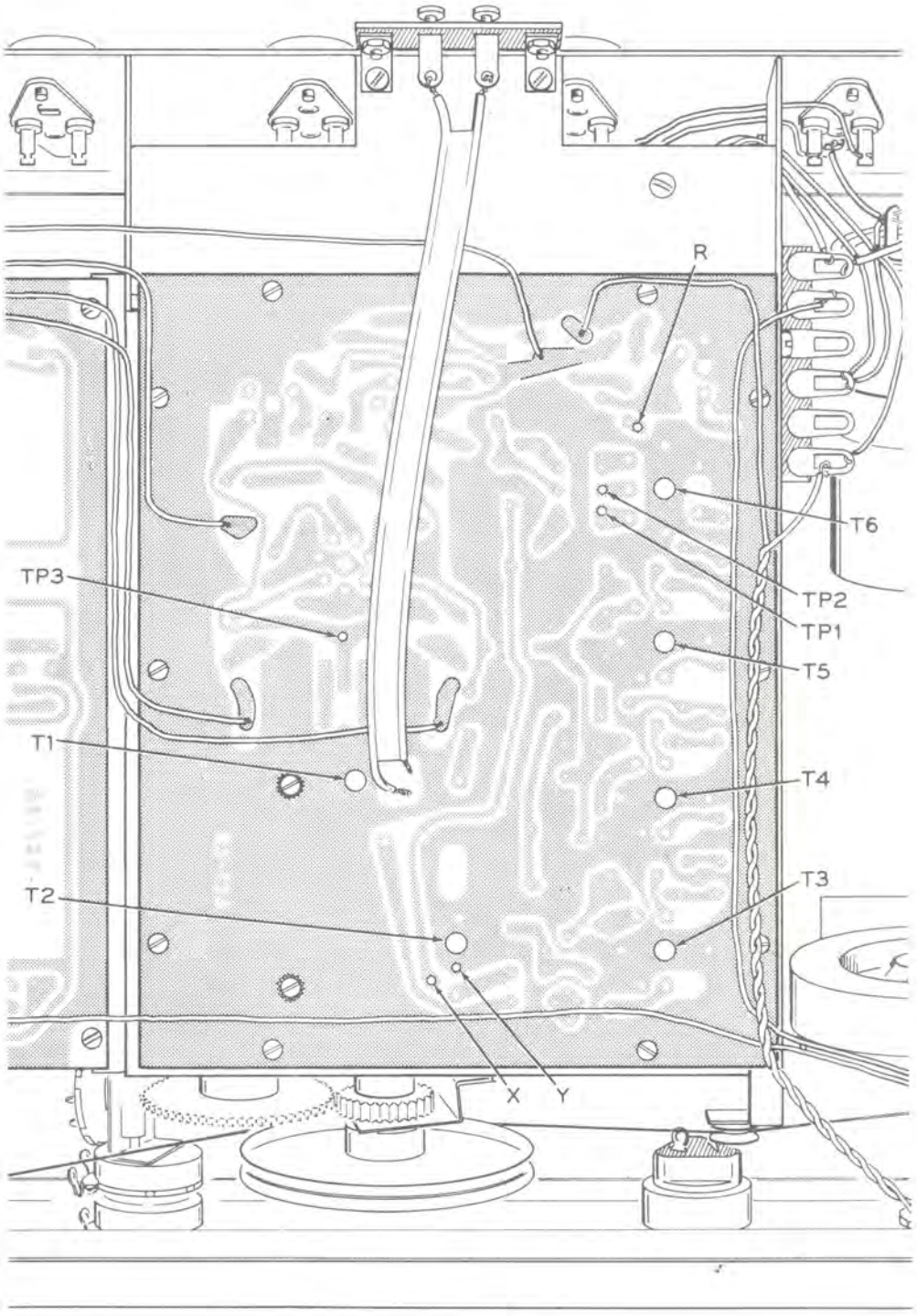
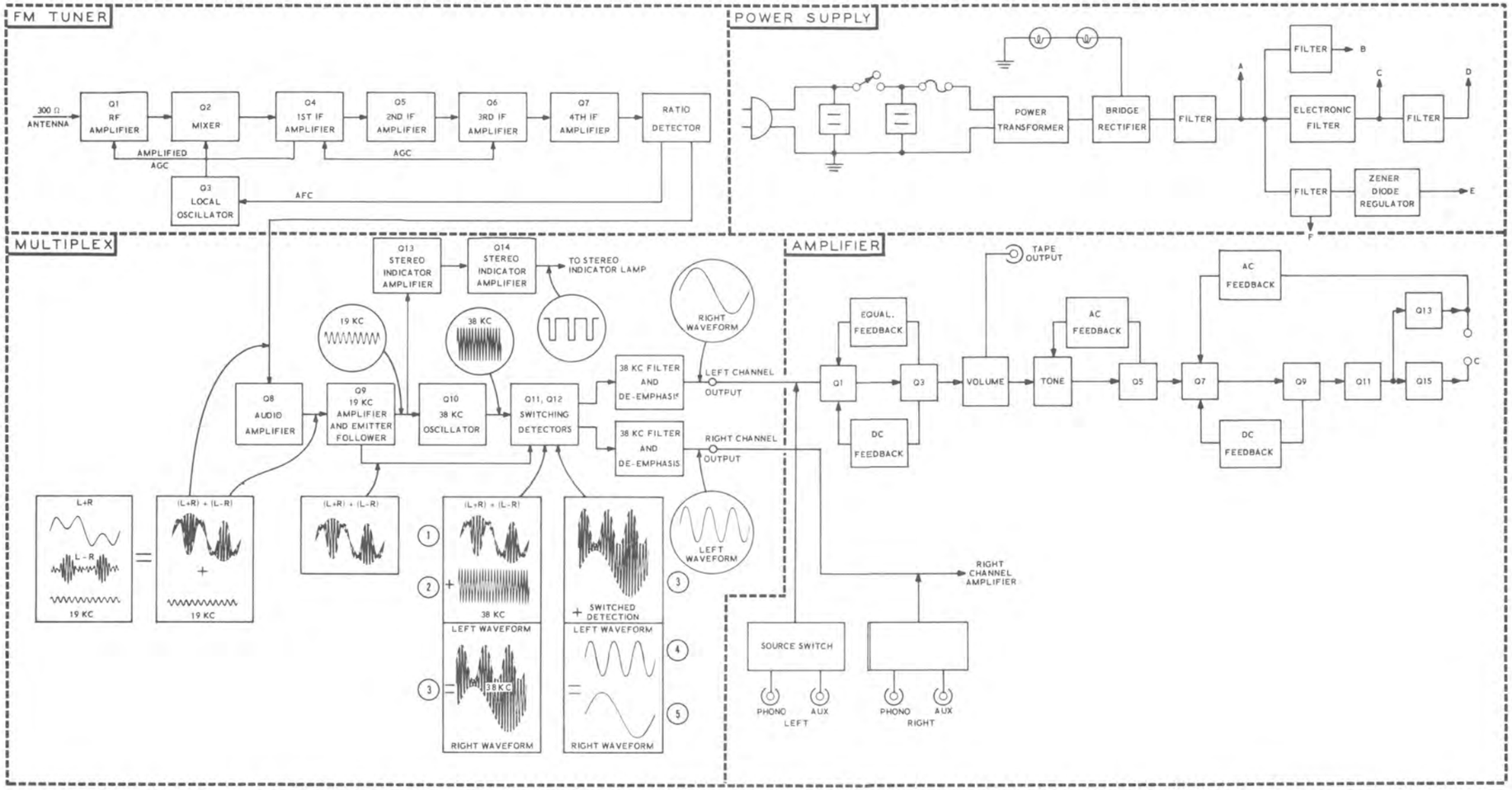


FIGURE 5

BLOCK DIAGRAM



Right Input Sockets	Phono. Auxiliary (AUX).
Tape Output Sockets	Left Channel. Right Channel.

GENERAL

Transistor Complement	1 - 2SA240* RF amplifier. 1 - 2SA239* oscillator. 1 - 2SA240 mixer. 4 - 2N2654 IF amplifier. 14- 2N2712* multiplex amplifier, 19 kc amplifier, emitter follower, 38 kc oscillator, switching detectors, stereo indicator amplifiers, second and third preamplifiers, first predriver, electronic filter. 2 - 2N3391* first preamplifier. 2 - 2N3416* second predriver. 2 - 2N3053* driver. 2 - TA2577A* output. 2 - 2N2148* output.
Diode Complement	2 - 1N3754* reference diode. 4 - F1* bridge rectifier diodes. 2 - ratio detector diodes (in can with transformer T6. 1 - AFC diode (in FM tuning unit).
Power Requirements	105-125 volts, 50/60 cps, 32 watts idling, 65 watts full output (no load on AC power sockets).
Dimensions	Overall: 15-1/4" wide x 3-7/8" high x 12" deep.
Mounting Position	Horizontal or vertical.
Custom Mounting Requirements	15" x 3-1/2" cutout, 11-1/2" deep from front mounting surface.
Net Weight	14 lbs.

*Or Equivalent

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

Each major section of the Receiver will be described separately in the following Circuit Description. For ease of explanation, the Source switch will be described in the FM position.

Follow the circuit on the Block Diagram (fold-out from Page 66) and on the Schematic (fold-out from Page 79) while reading the Circuit Description. The letter-number designations (R4, C115, R212) for all resistors, capacitors, and diodes have been placed into the following groups to make them easier to locate on the chassis and Schematic.

1 - 99	FM tuner section.
100 - 199	Amplifier section.
200 - 299	Power supply section.

FM TUNING UNIT

The FM signal from the antenna is applied to the primary of balanced input transformer T1 in the FM tuning unit. The secondary of transformer T1 forms a tuned circuit with trimmer capacitor C1 and capacitors C2 and C1A (antenna section of tuning capacitor). The signal selected by this tuned circuit is coupled through capacitor C3 to RF amplifier transistor Q1.

The signal is amplified by transistor Q1. The RF tuned circuit of Q1 selects the desired signal and couples it through capacitor C8 to the base of mixer transistor Q2. The RF tuned circuit consists of coil L2, trimmer capacitor C6, and capacitors C7 and C6A (RF portion of tuning capacitor).

The local oscillator transistor, Q3, operates at a frequency that is 10.7 mc higher than the received FM signal. The oscillator frequency is determined by a tuned circuit composed of coil L4, trimmer capacitor C14, and capacitors C13 and C14A (oscillator portion of tuning capacitor). The output signal from this oscillator is coupled through capacitor C10 to the base of mixer transistor Q2.

A small DC voltage is coupled from the ratio detector circuit through resistor R5 to diode D1 in the collector circuit of the oscillator. This DC voltage, which changes as the tuning is changed, is used as an AFC (automatic frequency control) voltage to lock-in the local oscillator frequency with the station being tuned in.

The oscillator frequency is locked-in by the AFC voltage in the following manner: The capacitance between the elements of diode D1 changes when the AFC voltage that is applied to it changes. This capacitance is connected in series with capacitor C19, and these two capacitances are connected in parallel with part of coil L4. Thus, when the capacitance of diode D1 is changed by the AFC voltage, the total capacitance across coil L4 is changed. This change in the tuned circuit capacitance changes the frequency of the oscillator in such a way as to maintain proper tuning.

The oscillator and the received FM signals are mixed in transistor Q2 to produce a 10.7 mc IF (intermediate frequency) signal, that is coupled through transformer T2 and capacitor C21 to the first IF amplifier transistor, Q4. The amplified IF signal from the collector of transistor Q4 is coupled through transformer T3 to the base of second IF amplifier transistor Q5. This IF signal is again amplified by transistor Q5, coupled through transformer T4, and amplified by transistor Q6. From Q6 the signal is coupled through transformer T5 and amplified by the fourth IF amplifier transistor Q7.

A portion of the signal voltage is taken from the collector of transistor Q6 and rectified by diode D2 to produce an AGC (automatic gain control) voltage. This AGC voltage, which increases and decreases with the strength of the received FM signal, is coupled through resistors R14 and R12 to the base of transistor Q4, where it automatically controls the gain of the IF signal.

The AGC voltage is then coupled from the emitter of transistor Q4, through resistor R10, to the base of RF amplifier transistor Q1. This automatically controls the gain of the FM signal in the tuner section.

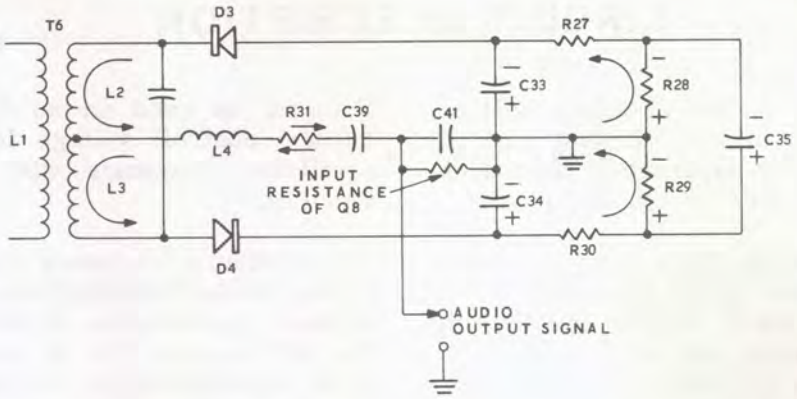


Figure 11

All, or only one of the IF amplifier stages may operate as limiters. For a very weak signal, only the fourth IF amplifier Q7 may be limiting, and transistors Q4, Q5, and Q6 would be amplifying the IF signal. For a very strong signal, all four IF amplifiers may be acting as limiters. This limiting action removes amplitude modulation from the FM signal. Limiting action is also provided by the self-limiting characteristics of the ratio detector circuit.

RATIO DETECTOR CIRCUIT

From the collector of transistor Q7, the IF signal is coupled through resistor R26 and ratio detector transformer T6 to the ratio detector circuit. This circuit, which separates the audio signal from the 10.7 mc IF signal, is shown redrawn for greater clarity and simplified in Figure 11. Transformer T6 is represented in this figure by primary coil L1, a center tapped secondary composed of coils L2 and L3, and a third or tertiary winding, L4. L4 is just a few turns of wire tightly wrapped around the bottom of primary L1. NOTE: In the actual circuit, choke L5 and coil L6 are also connected in series with coil L4, resistor R31, capacitor C39, and resistor R39.

Consider a separate voltage to be induced by the primary into each of the windings, L2, L3, and L4. L4, which is closely coupled to the primary introduces a voltage that is in series with both L2 and L3. This voltage across L4 is relatively constant in amplitude as long as the voltage across L1 does not change. (Remember, the voltage across L1 will stay relatively constant due to the limiting action of transistor Q7.) Notice that each diode has its own separate loop through which its current flows (indicated by the arrows). Current flowing in diode D3 is controlled by the voltage induced in L2 and L4 which charges capacitor C33. The current flowing in diode D4 is controlled by the voltage induced in coils L3 and L4 which charges capacitor C34. Current flows through L4 in both directions, since this coil is common to both current loops.

The two currents flow through capacitors C33 and C34 in the same direction. Electrolytic capacitor C35 is connected across both of these capacitors through resistors R27 and R30. This large capacitor keeps the total voltage across these two capacitors from changing, thus, any amplitude changes on the IF signal are damped out by this capacitor.

The audio output signal from the ratio detector circuit is applied to the base of Q8. Note that the two loop currents are flowing in opposite directions through coil L4, resistor R31, capacitor C39, and the input resistance of Q8. At the FM IF center frequency of 10.7 mc, the diode currents are equal, thus they cancel each other out and no voltage appears across the input resistance of Q8.

When the IF frequency deviates from 10.7 mc due to FM modulation (audio signal), the current in one diode loop increases while the current in the other loop decreases. These changes are caused by a change in phase relationship in the signal current across coils L2 and L4, and L3 and L4. Now current flows through the input resistance of Q8 in the direction of the larger signal, and an output voltage is developed

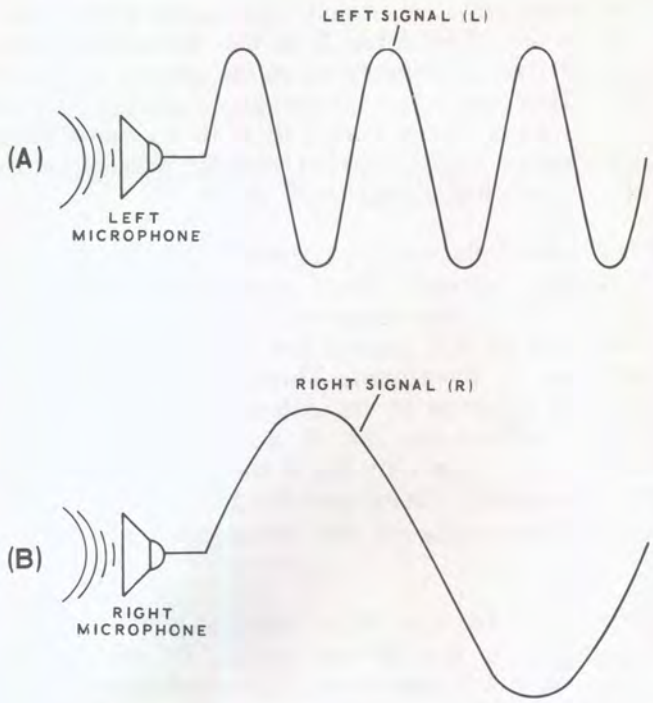


Figure 12

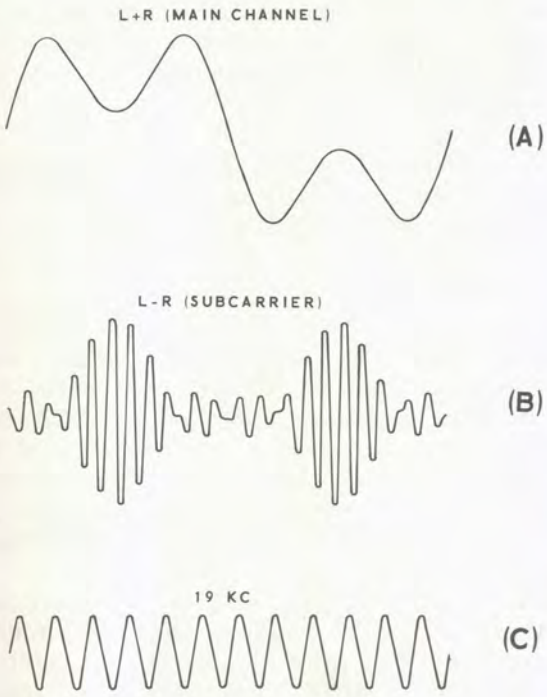


Figure 13

across the input resistance of Q8. The amplitude of this output voltage is determined by how far the IF frequency deviates from the center frequency of 10.7 mc. The frequency of this audio output voltage is determined by how often the frequency deviates from 10.7 mc.

The slug in the secondary of coil T6 is used to balance the ratio detector circuit. Capacitor C36 and L5 removes any remaining 10.7 mc IF signal from the audio signal. Resistors R28 and R29 are load resistors for diodes D3 and D4.

FM STEREO MULTIPLEX CIRCUIT

Figures 12A and 12B show two sample signals that might appear from the left (L) and right (R) channel microphones of a radio station that is broadcasting a stereo FM signal. The transmitting circuits then combine these signals to produce the L+R signal shown in Figure 13A and the L-R subcarrier signal shown in Figure 13B. The L-R subcarrier signal is a suppressed carrier amplitude modulated signal on a 38 kc subcarrier, and is called the subcarrier channel.

These two signals, L+R and L-R, are then combined with the 19 kc pilot signal shown in Figure 13C. This whole complex signal modulates the FM carrier and is then radiated from the broadcasting antenna.

Figure 14 shows the locations of the different components that modulate an FM stereo signal. The "main channel" signal is from 50 cps to 15 kc. Monaural FM tuners use only this part of the signal, and the remaining parts are attenuated by the tuners de-emphasis network.

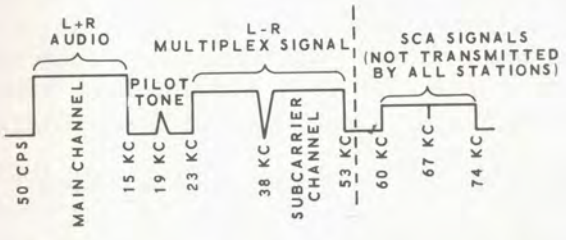


Figure 14

A 19 kc pilot signal is transmitted to give the proper phasing for the demodulated subcarrier channel. The 38 kc subcarrier channel is AM modulated from 23 kc to 53 kc.

A second subcarrier signal is transmitted by some stations at 67 kc. This is usually a commercial music signal. This signal is called the SCA (Subsidiary Communications Authorization) channel.

The signal that is used for stereo multiplex operation is coupled from the ratio detector, through capacitor C39 and the SCA filter, to audio amplifier transistor Q8. The SCA filter, which consists of coil L6 and capacitors C40 and C41, removes the 67 kc SCA signal. These signals are not used for stereo reception.

The complete stereo multiplex signal consists of the (L+R) main channel, the (L-R) subchannel, and the 19 kc pilot signal. The complete stereo signal is amplified by transistor Q8 and coupled through capacitor C43 to 19 kc amplifier transistor Q9. The collector circuit of transistor Q9 is tuned to 19 kc by coil L7 and capacitor C44. Phase control R43 and capacitor C45 are connected across a portion of coil L7 so the phase of the 19 kc signal can be adjusted. The 19 kc signal is then coupled to the base of the 38 kc oscillator transistor, Q10, where it locks the 38 kc oscillator in phase and frequency with the transmitted 38 kc subcarrier signal.

The 38 kc oscillator signal from transistor Q10 is applied through transformer T7 to the base circuits of switching detector transistors Q11 and Q12. At the same time, the main channel (L+R) and subchannel (L-R) signals are coupled from the emitter of transistor Q9 to the emitters of transistors Q11 and Q12.

When the main channel and subchannel signals are combined with the 38 kc oscillator signal in the switching detector circuit, the 38 kc carrier that was removed at the transmitter (suppressed carrier transmission) is reinserted into the stereo signal (waveform 3 on Block Diagram).

Figure 15 shows the various waveforms that are present in the switching detector circuit. Waveform 1 is the suppressed carrier stereo and main channel signal that comes from transistor Q9. Waveform 2 is the 38 kc oscillator signal that is reinserted in the stereo signal at the same phase and frequency as the original 38 kc carrier. Remember, this 38 kc oscillation was locked at the correct frequency and phase by the 19 kc pilot signal from Q9.

The actual detection process takes place in the following manner: When waveform 3 is applied to the switching detector transistors, Q12 only conducts on that part of the waveform that carries the L waveform. Thus, only the L waveform 4 appears at its output. Transistor Q11 only conducts on the R portion of the 38 kc waveform, thus only the R waveform 5 appears at its output. These are the left and right signals originating at the broadcasting station.

In Figure 16, the 38 kc signal is shown superimposed on the stereo signal. At each 38 kc peak on the L waveform, Q12 conducts and Q11 is cut off. At each 38 kc peak on the R waveform, Q12 is cut off and Q11 conducts. The L signal from transistor Q12, charges capacitor C54; the R signal from transistor Q11, charges capacitor C55.

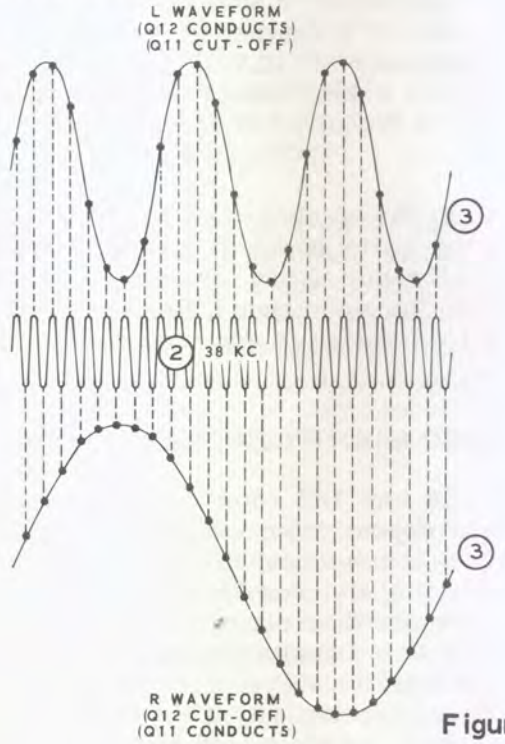


Figure 16

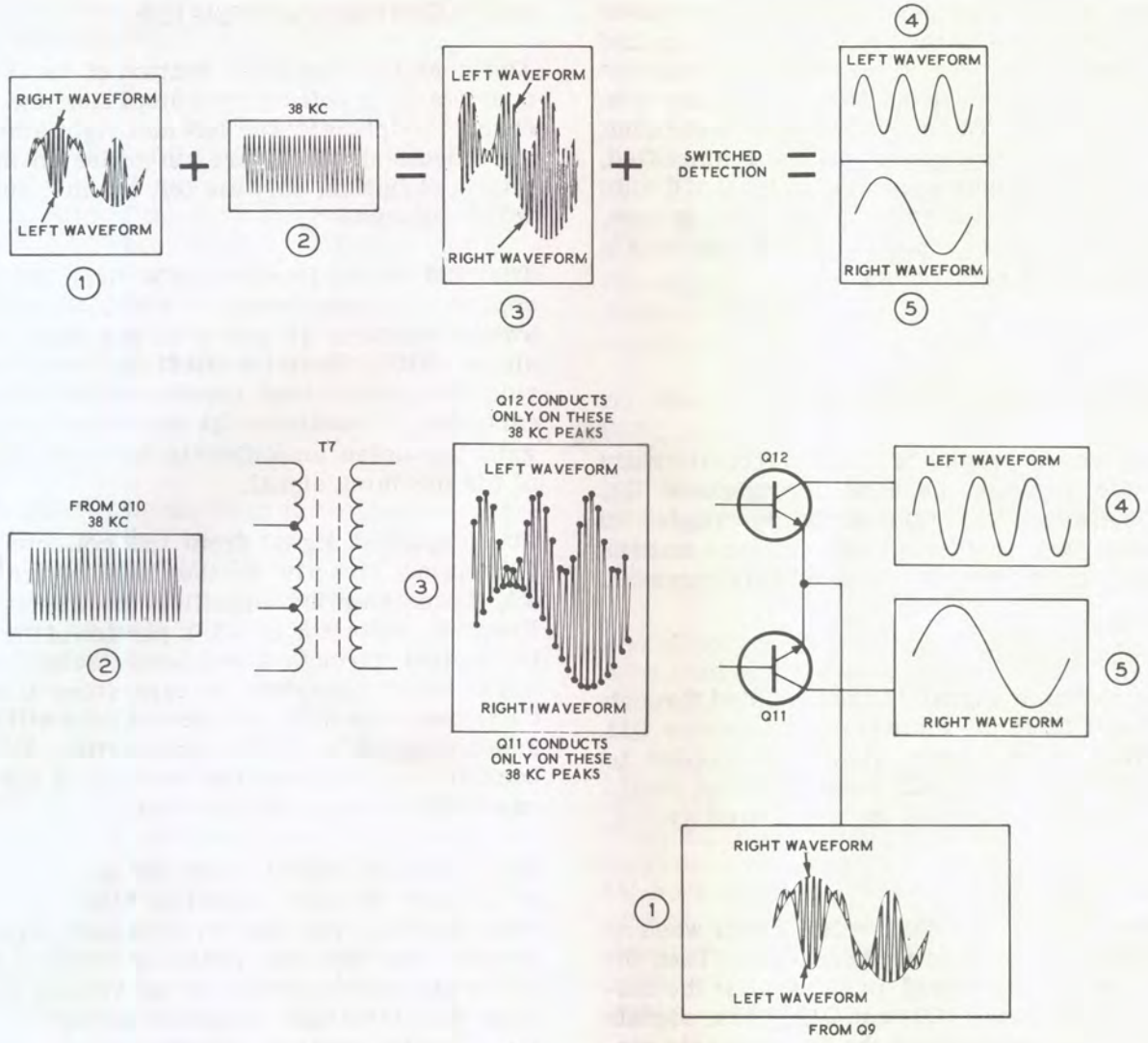


Figure 15

The left and right channel audio signals then are applied to individual 38 kc PEC filters that remove any remaining 38 kc signal. Proper de-emphasis of each signal is provided by the combinations of the PEC components and capacitors C57 and C58. The stereo signals are then connected to the Left and Right channel outputs.

When the Phase switch is in the "out" position, a 38 kc bandpass filter is connected into the circuit (coil L8 and capacitor C52. This circuit allows only the 38 kc subcarrier channel to pass through to transistors Q11 and Q12. The phase control is used to adjust for proper phasing between the reinserted 38 kc carrier and the 38 kc subcarrier signal. This insures maximum separation from the receiver. (The Phase control is adjusted by listening for maximum sound in the subcarrier signal; the presence of main channel sound would make this adjustment impossible.)

A small amount of the 19 kc signal is coupled from coil L7, through capacitor C38, to the base of stereo indicator amplifier transistor Q13. This 19 kc signal is only present when a stereo signal is being broadcast.

Transistor Q13 does not conduct current until the positive peaks of the 19 kc signal are applied to it. Then it only conducts until the time constant of resistor R35 and capacitor C38 cause it to stop conducting. The current pulses that result are applied to transistor Q14 and amplified. These pulses, produce an average level of 6 volts across the stereo indicator lamp. This, in turn, causes the lamp to light, indicating that an FM stereo signal is being received.

MONOPHONIC FM OPERATION

The monophonic signal is coupled from the ratio detector circuit to the base of transistor Q8. After amplification, this signal is coupled to transistor Q9. Q9 acts only as an emitter follower since no 19 kc signal is present.

The monophonic signal is then coupled through capacitor C52 to the emitters of transistor Q11 and Q12. No oscillator signal is coupled to transistors Q11 and Q12, since the 38 kc oscillator circuit is disabled by the Source switch.

Transistors Q11 and Q12 will conduct when no 38 kc signal is applied to their bases. Then the same monophonic signal is present at the collectors of transistors Q11 and Q12. These signals are then coupled through the de-emphasis circuits to the Left and Right channel outputs.

LEFT CHANNEL AMPLIFIER

The complete amplifier section of the Receiver consists of a left channel amplifier and a right channel amplifier. The left and right amplifiers are identical; therefore, in order to simplify this description, only the left channel amplifier will be discussed.

The FM signal from the FM tuner section is applied through resistor R105 and Source switch contacts 12 and 3 to the base of transistor Q100. Resistor R111 is used to provide the proper load impedance for the phono cartridge. Transistor Q1 operates as a high-gain low-noise amplifier to increase the level of the incoming signal.

The amplified signal from the collector of Q1 is applied directly to the base of transistor Q3. Transistor Q3 amplifies the signal again. From the collector of Q3, a portion of the signal is applied through a frequency selective network, which consists of capacitors C105 and C109, resistor R125, and the Source switch. This network provides RIAA equalization. DC feedback is applied from the emitter of Q3 to the base of Q1 through resistor R117.

The equalized signal from the collector of Q3 is applied through capacitor C107 to Volume control R129. The amount of signal required to produce the desired listening level is tapped off by the slider portion of the Volume control. This signal voltage is applied through the Bass and Treble control circuits to the base of amplifier transistor Q5.

The signal from C107 is also applied through isolation resistors R181 and R183 to the Tape Output jack.

Transistor Q5 further amplifies the signal. A small portion of the signal from the collector of Q5 is applied as feedback through capacitor C117 and part of the tone control network to the base of Q5. The output signal from the collector of Q5 is coupled through capacitor C119 and resistor R149 to the base of transistor Q7. Transistors Q7 and Q9 are direct-coupled amplifiers which further amplify the signal. The amplified signal from the collector of Q9 is coupled through capacitor C125 to the base of driver transistor Q11.

The amplified signal from the collector of Q11 is applied to the bases of the output transistors, Q13 and Q15. Diode D101 determines the AB operating point of the output transistors, eliminates crossover distortion, and also provides temperature stability.

Transistors Q13 and Q15 are connected as a push-pull output stage. The output signal from this stage is applied through capacitor C129 and the switch contacts on the rear of the Bass control to the speakers. The output signal is also applied across a voltage divider network made up of resistors R173 and R175. The voltage divider applies a portion of the signal through resistor R151 and capacitor C121 as overall negative feedback to the base of transistor Q7. If a stereo headphone set is plugged into the Phone jack, the signal is applied to the headphones. The speaker can be disconnected using the switch on the Bass control.

POWER SUPPLY

The fused transformer-operated power supply uses four silicon diodes, D200 through D203, in a bridge rectifier circuit. Capacitor C201 filters the supply voltage for the power output stages. Resistor R201 and capacitor C202 provide the supply voltage for the stereo indicator lamp.

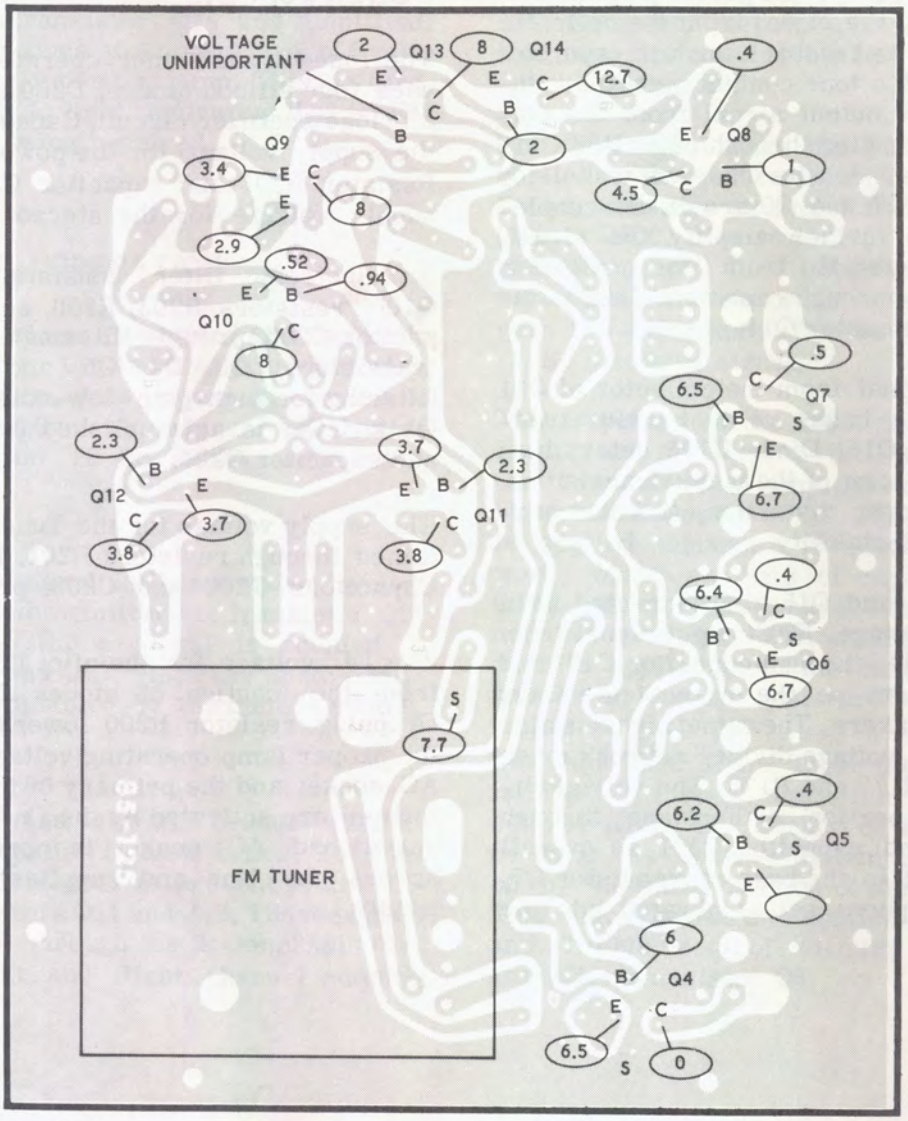
An electronic filter, consisting of transistor Q100, resistors R205, R206, and R207, and capacitor C205, provide filtering for preamplifier transistors, Q3, Q4, Q5, and Q6. The final filtering for high-gain low-noise preamplifiers Q1 and Q2, is accomplished by resistor R204 and capacitor C204.

The supply voltage for the Tuner section is obtained through resistors R201, R202, and R203. Capacitors C202 and C203, provide filtering.

The DC voltage for the pilot lamps is obtained from the junction of diodes D200 and D202. Dropping resistor R200 lowers the voltage to the proper lamp operating voltage. The switched AC socket and the primary of the power transformer are activated by the On-Off switch. The unswitched AC socket is connected directly across the line and supplies power continuously.

VOLTAGE CHART

FM - MULTIPLEX CIRCUIT BOARD



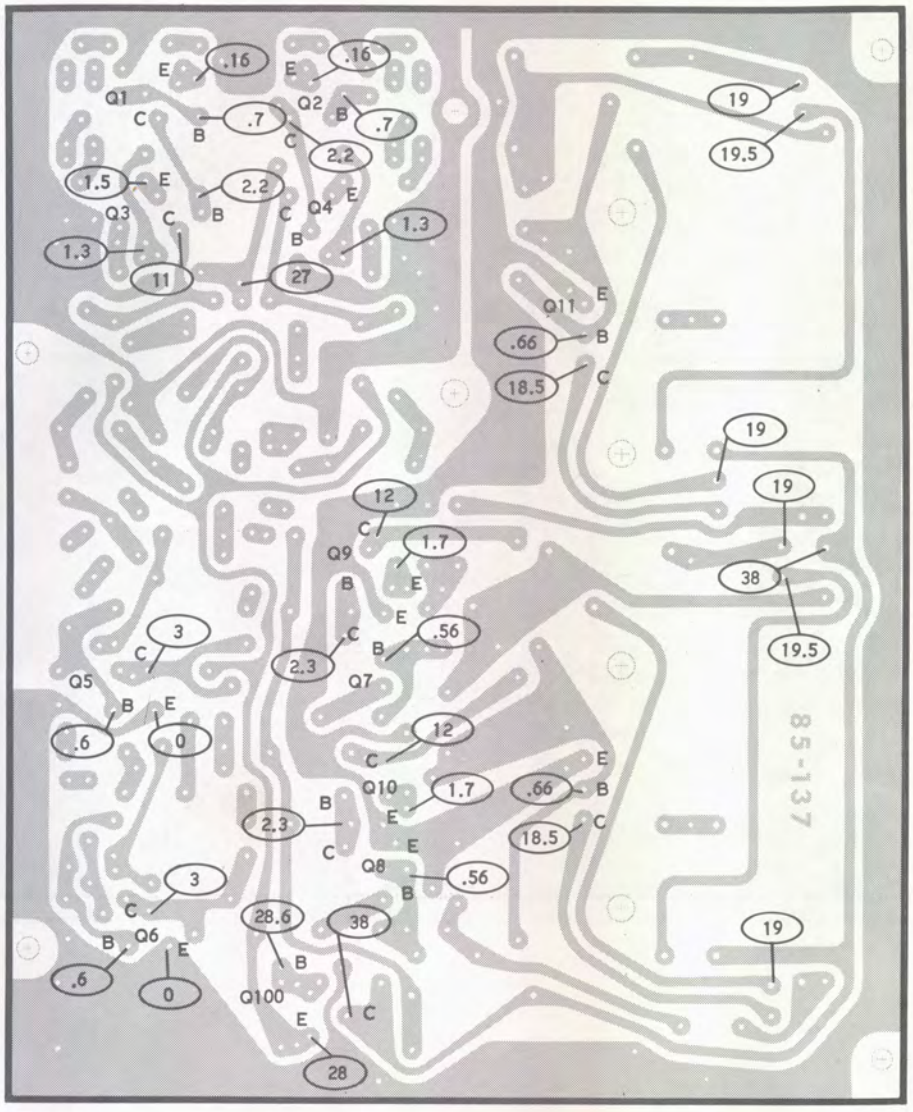
NOTES:

1. ALL VOLTAGES ARE DC POSITIVE, TAKEN WITH AN 11 MEGOHM INPUT VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±20%.
2. VOLTAGES MEASURED WITH THE SOURCE SWITCH IN (S) FM POSITION.
3. PHASE SWITCH PUSHED IN (OFF) POSITION.
4. ANTENNA DISCONNECTED.

Figure 17

VOLTAGE CHART

AMPLIFIER CIRCUIT BOARD



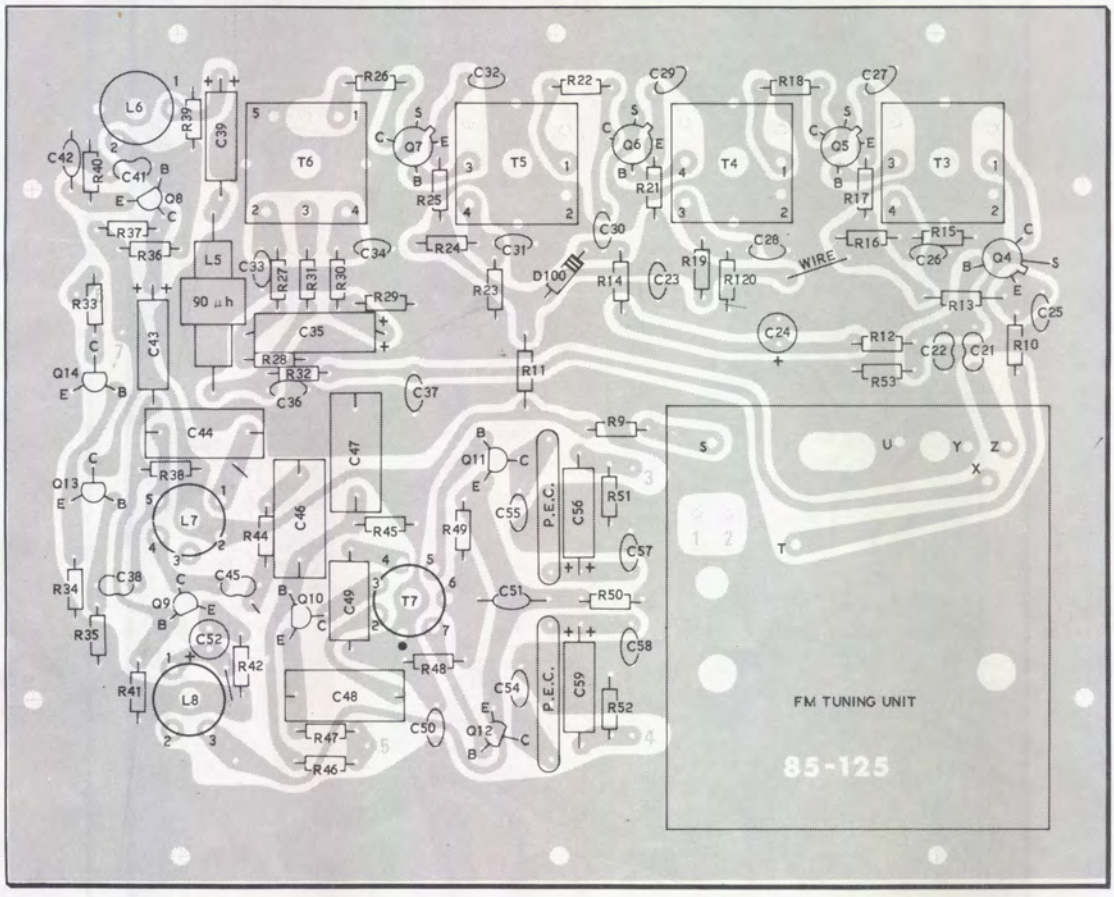
NOTES:

1. ALL VOLTAGES ARE DC POSITIVE, TAKEN WITH AN 11 MEGOHM INPUT VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±20%.
2. VOLTAGES MEASURED WITH THE SOURCE SWITCH IN (S) FM POSITION.
3. PHASE SWITCH PUSHED IN (OFF) POSITION.
4. ANTENNA DISCONNECTED.

Figure 18

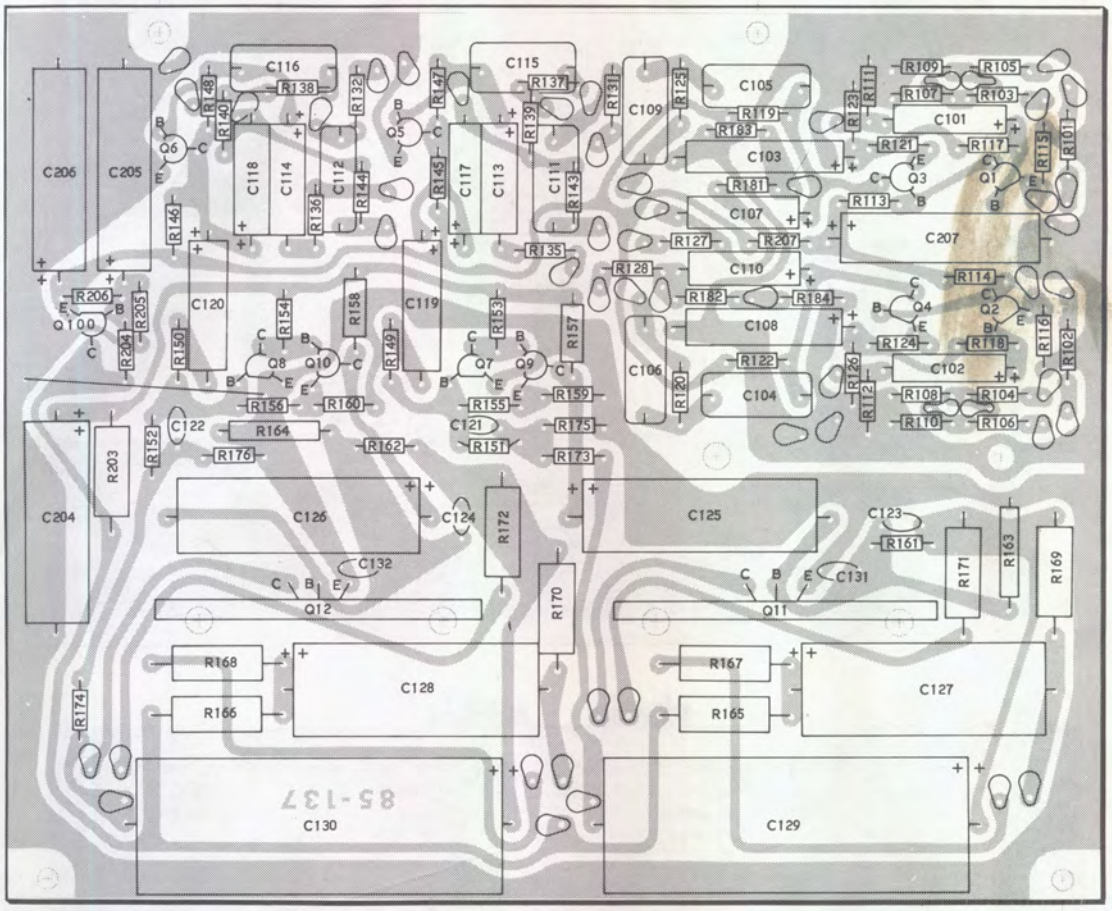
X-RAY VIEW

FM - MULTIPLEX CIRCUIT BOARD
(Viewed From Foil Side)

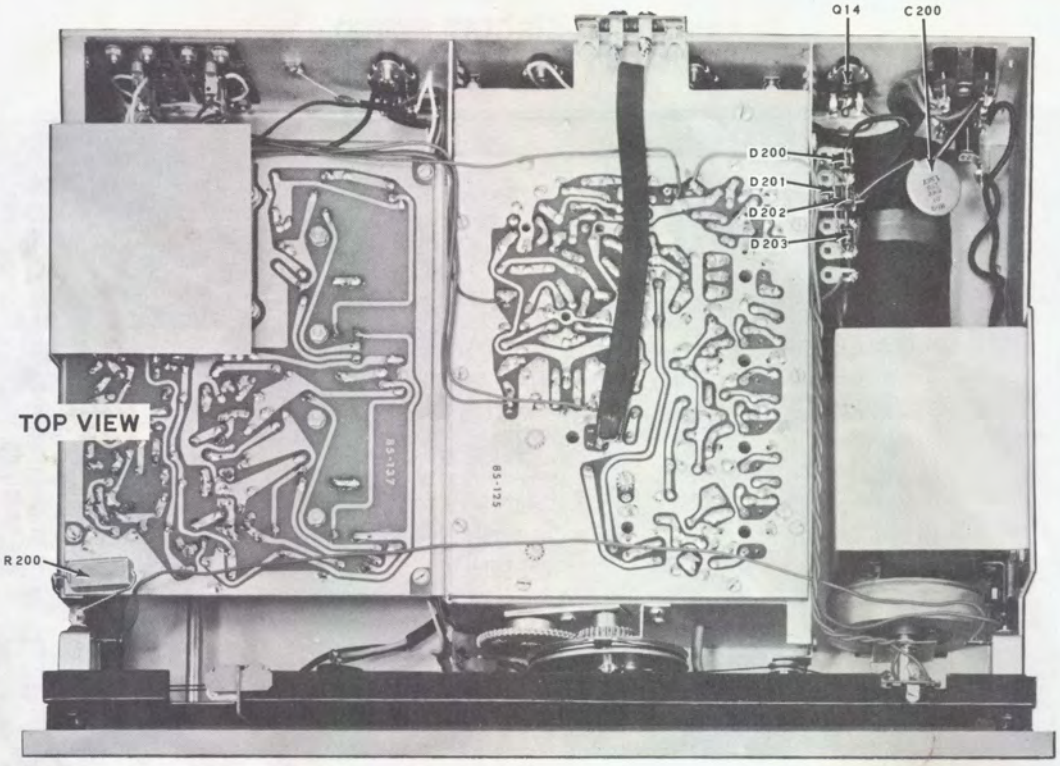


X-RAY VIEW

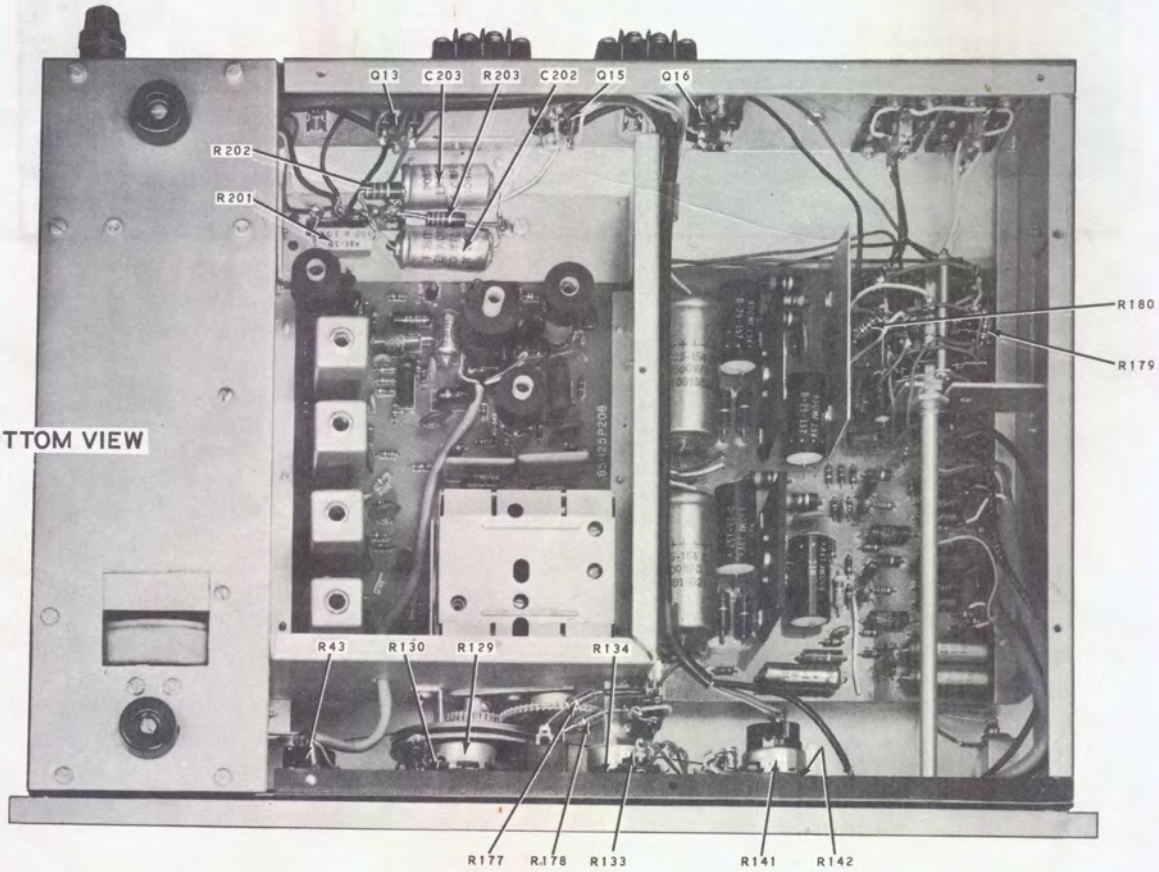
AMPLIFIER CIRCUIT BOARD
(Viewed From Foil Side)



CHASSIS PHOTOGRAPHS



TOP VIEW



BOTTOM VIEW

12/31/94
Repl C 119, 120, 114, 118. RTCH GAIN
STILL LESS THAN C

11/3/83 - Replaced C103 & Q3
11/19/94 replaced fuse with 2A

FM MULTIPLEX CIRCUIT BOARD

FM TUNING UNIT

IF CIRCUIT

RATIO DETECTOR CIRCUIT

POWER SUPPLY

replaced with LED

PHASE

ON PHASE ADJUST CONTROL

AMPLIFIER CIRCUIT BOARD

SOURCE

LEFT CHANNEL

RIGHT CHANNEL

NPN

NPN

PHONO Changed INPUT TO MATCH AUX

SCHEMATIC OF THE HEATHKIT® SOLID STATE FM RECEIVER MODEL AR-14

TRANSISTOR LEAD IDENTIFICATION

Q4,Q5 Q8,Q7 &Q10

Q8-Q14 Q101-Q105

Q11,Q112

Q13,Q14, Q15 & Q16

NOTES:

1. RESISTOR AND CAPACITOR NUMBERS ARE IN THE FOLLOWING GROUPS:
   0 - 99 NUMBERS IN THE FM TUNER SECTION.
   100 - 199 NUMBERS IN THE AMPLIFIER. COMPONENTS, EVEN NUMBERS INDICATE RIGHT CHANNEL COMPONENTS.
   200 - 299 PARTS IN THE POWER SUPPLY.
2. ALL RESISTORS ARE 1/4 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS ("K" = 1000, MEG = 1,000,000.
3. ALL CAPACITOR VALUES ARE IN .M UNLESS MARKED OTHERWISE.
4. ◯ THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT. TAKEN WITH AN 11 MEGOHM VTVM FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY 10%.
5. [ ] INDICATES B+ VOLTAGE POINTS.
6. ◇ INDICATES CONNECTING POINTS ON AMPLIFIER CIRCUIT BOARD.
7. ◯ INDICATES CONNECTING POINTS ON FM TUNER CIRCUIT BOARD.
8. SOURCE SWITCH SHOWN IN FULL COUNTERCLOCKWISE POSITION AS VIEWED FROM THE FRONT.
9. REFER TO THE CIRCUIT-BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.
10. INDICATES CW ROTATION.
11. MEASUREMENTS MADE WITHOUT ANTENNA CONNECTED, SWITCH SET AT STEREO POSITION, AND PHASE SWITCH PUSHED IN.
12. INDICATES TEST POINTS.
* Q1 MAY BE A 2SA153 OR 2SA105 TRANSISTOR.
** Q7 MAY BE A 2SA135 TRANSISTOR.
[NOTE] TRANSISTORS Q8 THROUGH Q13 HAVE AN ORANGE DOT AND Q14 HAS A BLUE DOT.

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